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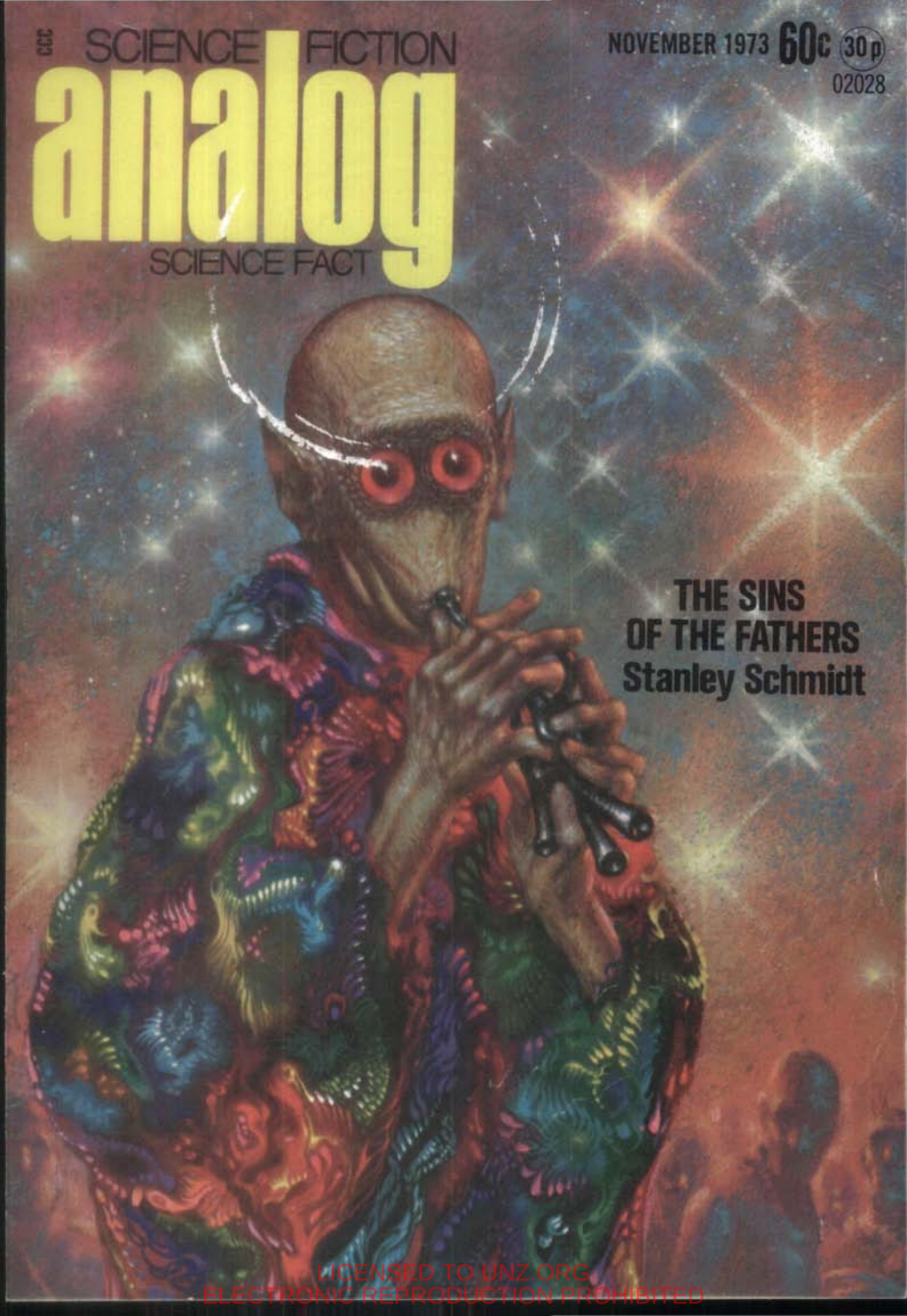

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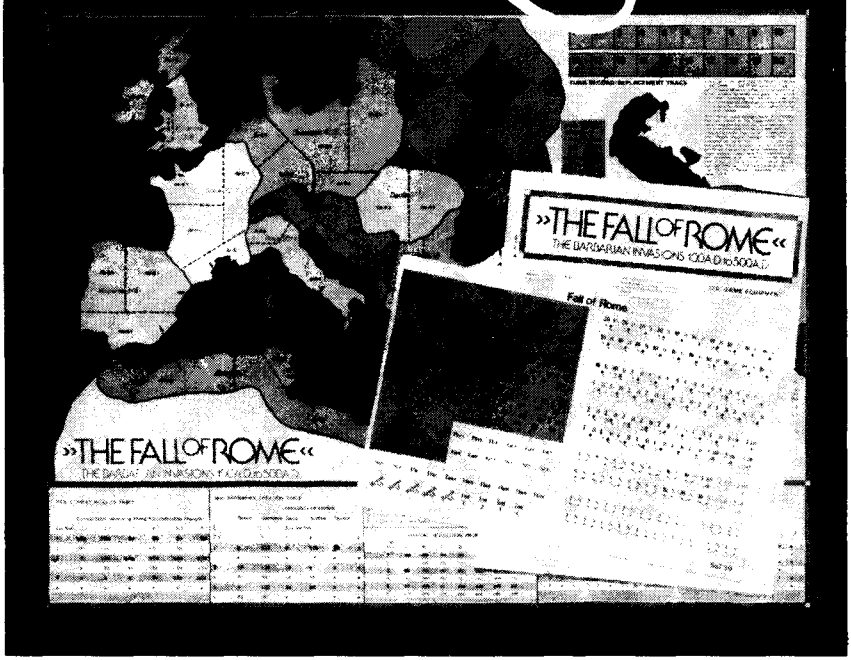
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Quis custodiet . . . ?

There will be references to some aspects of the Watergate scandal in this editorial, and if that's going to be too much for you to bear, then perhaps you'd better wait until next month. We'll talk about astronomy and cosmology then. Simple things.

At the moment this is being written, there are vast clouds of confusion and mystery hanging over the Senate Watergate hearings. I have no intention of pointing fingers, making accusations, supporting one side or the other. Due process of law should prevail, and neither newspaper accounts, television analyses, nor magazine editorials are going to get to the bottom of the Watergate problem. In this democracy, a man is innocent until *proven* guilty. So be it.

The aspect of the Watergate affair that fascinates me is a little-noticed quote from an official of the National Science Foundation. With reporters uncovering wider and wider connections all through the government, more and more agencies involved either in the original break-in or the subsequent cover-up, one newsman asked this NSF scientist if the National Science Foundation had anything to do with Watergate.

The scientist blanched at the thought, but then added: "If we had anything to do with it, do you think they would've used those Stone Age electronics?"

The technology of electronics has reached a point that makes the latest James Bond movies look amateurish. It's now possible, in theory at least, to point a laser at a window across the street and detect the vibrations in the window caused by people speaking inside the room. The vibrations, recorded holograph-

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ically, can then be deciphered and the original talk reconstructed. Bugging without bugs!

The history of Western civilization has been a constant dynamic tension between the needs of the community--tribe, fief, barony, national state—and the rights of the individual. The American Revolution began as a celebration of the ascendency of individual human rights over the demands of the state. The Constitution was a definite step in the other direction, and many patriots--including the fiery Patrick Henry--called the Constitution *a sellout to the monied class* of property owners. In fact, the Constitution was finally ratified and put into effect only after the Bill of Rights was promised as a series of amendments.

Technology has played a curious role in the tension between state and individual.

Gunpowder and cannon made it possible for kings to overpower knightly barons and set up modern nation-states. That Renaissance type of technology—and the new techniques for amassing and handling money—allowed kings to bring together armies that were too strong for the armored barons to fight in the field, and too heavy in firepower to withstand in their castles. Before gunpowder, a king was merely one baron among many, owed a traditional allegiance by his peers. With cannon and hired troops, kings became true rulers of nation-states, and the rest of the aristocracy slowly but inevitably became courtiers.

It took centuries for the gunpowder technology to become simple and reliable and well-understood enough to trickle down into the hands of the common man. When it did--there was revolution. Not that there hadn't been revolts before. But with muskets in their hands, the yeoman farmers, or peasants, or city riffraff, could become *successful* revolutionaries.

The new technology of deep-ocean sailing allowed Europeans to *settle the Americas. That in itself* was a contribution from technology to individual freedom. The mature technology of musketry allowed the colonists to battle professional armies on a nearly-equal footing. George Washington's ragged army lost most of its battles, true. But it won the war. If the Redcoats had muskets and the colonials had nothing but crossbows, it might have been a very different outcome.

Across the ocean, in France, not only did city mobs topple the old order, but hastily-assembled armies led by very young officers, for the most part, stood off the finest professional armies of Europe, as the other kings tried to restore their deposed Bourbon cousins. Again, it was the fact that kings no longer had a monopoly on firepower that allowed the French citizen-armies to hold their own.

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EDITOR'S NOTE

For years John W. Campbell told anyone who asked him about the labors of editing Astounding and Analog, "It's easy. All I do is read stories and have bull sessions with the writers and artists. Miss Tarrant does all the real work." No one ever believed him, but I found out that it was perfectly true.

Catherine Tarrant is a very private person. She has always shunned publicity. She has always preferred to do her work and let the Editor take credit for it. Astounding and Analog have been the result of her dedication, her selflessness, her hard and painstaking hours of toil.

On July 26, 1973, Kay retired from Condé Nast Publications. She would probably get flustered if I mentioned anything about her length of service, or how this magazine will never be the same without her. As it is, even this brief note is probably embarrassing to her.

But there is no other way of saying a proper "Thank You" to her. Astounding and Analog have been as much "your" magazines, Kay, as they were John Campbell's or anyone else's. Good luck to you in your retirement. God bless you. We all miss you.

We've all seen countless Western movies in which the Good Guys scorn the thought of someone giving rifles to the Indians. It doesn't work that simple in real life. Custer's last words might well have been not "Too many gold-diggers' fortunes" but "Too many Indians with rifles." Repeating rifles, maybe.

More the same problem has plagued our military engagement in Southeast Asia. (Where the enemy has often been called Indians, I think, out of respect.)

Back in the mid-1960's, when our heavy military commitment in Vietnam was just getting underway, Americans were confident that our powerful, modern, well-equipped army could make quick work of the "simple villagers and peasants" on the other side. Turned out the peasants had automatic rifles that worked better than ours, transistor radios, very effective mortars, even rocket-assisted mortars, plus other technological goodies. By using these weapons in harmony with the geography and social environment of Southeast Asia, and under a home-grown tactical discipline that was ideally suited for that environment, the simple peasants held their own.

And, of course, in the air war the North Vietnamese had the use of quite modern antiaircraft defenses.

Southeast Asia has shown that relatively unsophisticated people

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can quickly adapt to the use of modern weaponry and face a strong, professional army on a less-than-hopeless basis.

The terrorism spreading from the Mideast shows that modern technology can be used to attack the very fabric of society. The Israelis have been quite convincing in their displays of military strength. Using every technological advantage they could muster, they have repeatedly defeated Arab armies that had modern weaponry but antique leadership.

However, a technology capable of producing cheap plastic explosives and expensive commercial jet airliners has proven to be a volatile mix. The military battles in the Mideast have not been decisive, partly because it's possible to carry on a paramilitary war of terror by smuggling frightfully lethal weapons onto frighteningly fragile airliners.

Getting back to the United States, the tension between individual rights and the requirements of the state reached a peak of violence in the 1960's and early '70's. Although several prominent government officials apparently believed that there was a conspiracy afoot—possibly Communist-inspired and supported—the evidence seems to indicate that there wasn't a national protest movement, *per se*, but rather lots of different groups of people, with different aims and intensities of feeling, who were protesting many things: the Southeast Asia war, racial injustice, the draft, governmental high-handedness, police brutality, drug laws, et cetera.

Modern technology helped to make these protests highly effective. Television gave even the tiniest knots of sign-wielding protesters instant national publicity. Telephones and automobiles and jet airliners gave protesters easy nationwide communications.

And, for the more bloody-minded (or perhaps mindless) of them, weapons technology gave them explosives and guns. The tactics of terrorism seemed to work elsewhere, and they were tried here.

There were bombings, and bomb threats. There were scares, real and imaginary. Set against a background of airliner highjackings, assassinations of political figures, and riots, the increasing scale of violence apparently alarmed many government officials so much that they declared a sort of war on all protest movements and protesters.

It was largely a secret war, and the evidence indicates that it had highly political overtones. Partisan political, that is.

An important part of that battle was the use of electronic technology for intelligence-gathering and surveillance purposes.

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the government apparatus there's certainly a dossier on you—at the Internal Revenue Service, if nowhere else. It is possible that your phone has been bugged, either by the telephone company itself, or some governmental agency, on a routine check.

Of what? Is it really necessary to poke into a citizen's private life? Is it vital to the national security? Are we so threatened by aggressors beyond our borders or traitors within our midst that we must live under constant suspicion? I believe not. I don't think there is any nation or combination of nations that could conquer this country of ours. Destroy us, yes; with nuclear missiles or bacterial agents. But that is a threat that every human being on this planet faces, for our retaliation against such a doomsday attack would be swift and certain and devastating.

Neither do I believe that protest against the government, even violent protest, is much of a threat to our way of life. Our political system is built around the right to protest, along peaceful lines. The violence and excesses of groups such as the Weathermen turned off most Americans; turned the majority of our citizens against the perpetrators of the violence and the causes they espoused. The protest movement—or movements, plural, really—have accomplished many things. Our military involvement in Southeast Asia is almost at an end. The draft has been abolished. The tide of racial equality is rising for millions of Blacks, Chicanos, Indians . . . and even women. It wasn't the violence that accomplished these things. It was the decision by most Americans that the protesters had some right on their side, that the goals they sought were both legitimate and desirable.

But because of the widespread protest, and the government's self-defensive measures against it, the art of electronic snooping became a prime tool not only of government agencies, but of some industrial organizations as well.

The state-of-the-art of electronics technology is such, right now, that governmental or industrial agencies can spy on the average citizen very easily. Without his knowing it. That technology has not yet reached the point of simplicity and easy access where the average citizen can protect himself against such illegal spying.

And what does the future hold?

Remember the NSF man's quote. The Watergate bugging used "Stone Age electronics." It is possible for much subtler and more sophisticated surveillance and snooping to be perpetrated. For all we know, it's going on right now.

Not because there are inherently evil men in places of power. Merely because of a kind of law of physics: if there's a new tool around, somebody will use it.

continued on page 178

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When we finally jumped back into normal space, the three of us uncovered one of the big ports and gathered around it, drinking in the stars with a sense of relief and exhilaration I can't begin to describe. I'm a stable man—otherwise I wouldn't have had a chance at this job—but nobody can spend two months in a tin can, cut off from all direct evidence that the rest of the universe exists, without its getting to him at least a little. So it was a great feeling to be back among real, glowing stars.

Of course, the stars themselves reminded us we were a long way from home. The constellations don't change quite as much as you might think in a hundred and thirty light-years, but they change a lot—enough so we couldn't find any part of the sky to feel at home with. And the thought that we had, in a sense, also gone a hundred and thirty years into Earth's past didn't help us feel any less isolated.

For a moment I almost grasped the full reality of our situation, and I shivered a little. Dirk Borowski, the skipper, felt it too. "The mind boggles," he said, very quietly. "Three of us out here, over a hundred light-years from any other member of our species. And some of them are star-hopping too—though closer to home. Who would have thought we'd be so far so soon?"

We were silent for a while. Then Lewiston, the astronomer behind our mission, slapped both hands down against his sides as if to shatter our mood and turned away from the port. "Well," he announced, "we're here and we have work to do. I hope your timing was good, Skipper." And he walked briskly away to start his observations of S Andromedae. I never got any idea how much he shared our feelings when the stars came back. I'd already learned that he kept any feelings he might have neatly hidden behind a perpetual grin that reminded me of a mild-mannered Cheshire cat, and this was no exception.

I followed him across the cabin. He stopped and activated a large curved screen. Mostly, it darkened; but pinpoint images of stars, accurately brightness-coded, sprang into being all over it. I checked the automatic instruments that were to carry out a dozen other experiments, then activated another screen similar to Lewiston's. It would show me the entire sky either as we actually saw it from here or as astronomers on Earth had predicted we should—and by asking the computer to compare the two views and point out discrepancies, with little red circles on the screen, I might discover significant things never before suspected.

There were three red circles, and one of them, in a region of dense star-clouds, I couldn't explain away. "Dr. Lewiston," I said, "I've found an anomaly."

"Just a minute, Mr. Turabian. I'm busy right now." While I waited, it seemed to me that some-

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thing about the anomaly's location should be ringing a bell in my mind. But I wasn't used to seeing the sky from this viewpoint . . .

When Lewiston saw it, his grin seemed to increase a little—although changes in it were always so slight as to be uncertain. "Interesting, all right," he muttered. "Wouldn't want to get our hopes up, but it could be a fresh supernova right here in our galaxy. Even better than S Andromedae. Talk about serendipity!"

It was serendipity, all right, but not the way he was thinking. By that time I'd clarified in my mind what was special about the anomaly's position. "Do you suppose there's any special significance in its being in that direction?" I asked.

For a full second, his Cheshire grin deserted him completely.

And that I found frightening.

From the trip journal of
Jonel Turabian

I

Henry Clark, Lieutenant Commissioner of Grants, stood in the main cabin of the newly returned *Archaeopteryx* and watched, slightly dazed by the events of the last few hours, as two white-coated attendants led Donald Lewiston out into the Florida sun. The once-eminent astronomer looked only slightly more unkempt than before the trip, with the same plain and slightly sloppy suit and the same token collection of brown hairs plastered radially around his bald spot, but his face had changed immeasurably. There was a dazed blankness in his eyes now that was chilling to behold, and he let himself be led away with neither resistance nor cooperation of any kind.

Only minutes earlier, Clark had watched other attendants remove the corpse of Skipper Borowski from the ship's freezer, cover it, and wheel it on a cart through the same door. And he still had only the dimmest possible understanding of what had happened.

For him, it had begun with the urgent message that the *Archaeopteryx* was on the verge of landing—and that Ship's Mate Jonel Turabian was in command and wanted to see Clark and nobody but Clark when he arrived. Now Turabian emerged from the automatic debriefing chamber that had been brought aboard and said quietly, "I'm sorry this has to be your first look at our triumphant return, Mr. Clark. I guess you can see now why I didn't want anybody coming aboard right away except you and a few attendants you could trust."

Clark nodded absently, noting at the same time that his glasses were pinching his nose and he would have to get them fixed. "Yes, of course. Quite a mess. I'm still not clear on what happened. You say Dr Lewiston went berserk and attacked Borowski?"

"Yes. From behind. With one of our bulkhead tools, which is basi-

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cally a very big wrench with several special-purpose attachments." Turabian, young, slender, and dark-skinned, was carefully and thoroughly conditioned both physically and mentally, and Clark envied his calm self-control under the present circumstances. Of course, he had had a lot of time to adjust to them . . . "I managed to pull him off and subdue him, but too late," Turabian said.

"A pity," said Clark. "You tried, anyway. What do you suppose happened to unsettle him like that? Lewiston, I mean."

Turabian shrugged. "It happened in super-c. Can you imagine what that's like? When you're going faster than light, you can't see any of the normal objects. And if you look out a port, there's nothing there. Absolutely nothing. So you learn not to look out ports—but when you're in super-c week after week without a break, you're likely to think about it now and then. The Rao-Chang drive is so new there's no medical data to back me up, but I'd bet that that feeling of isolation can be rough on the marginally stable. And I'd say Lewiston fit that description. I guess it just got to him."

Clark raised an eyebrow. He was unused to hearing one of the world's top astronomers described in such terms. "Oh?"

"I'd say so. Did you know him, Mr. Clark?"

"Slightly."

"You may have noticed his facial expression. He grinned—always. It wasn't an unpleasant grin, but it was always the same, so you could never tell what he was thinking. I think it was a mask he cultivated deliberately. He always seemed unemotional, but I've got a hunch that a good deal went on inside, with a tight lid on it. The grin was all you saw until the lid blew—but if there was enough under the lid, it might not take much to blow it."

Clark nodded noncommittally. He hadn't known the man well, but from the little he remembered and the little he knew about psychology, Turabian's explanation might be plausible. Still, it was shocking to think of the astronomer suddenly turning on the captain of the ship whose launching he had inspired. Committing violent, senseless murder . . .

He changed the subject. "We should try to remember Dr. Lewiston as he *was*. Did he get the spectra he wanted from S Andromedae?"

"Yes. They're quite good."

"And you brought them back safely?"

"Yes. Those, and the results of all the other experiments we were commissioned to do. We were all finished with those and well on our way home before—"

"Good." Anxious to avoid, for the moment, getting back to the murder *(was it murder if Lewiston was insane at the time?),* Clark

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asked quickly, "Could you show me some of your findings?"

"I'd rather not now, if you don't mind." Turabian looked past the still-open hatch at the sunshine and landing field and the blue sky and tropical plants and ocean beyond. He smiled apologetically. "A little later, certainly. But please remember I've just been through the same months of isolation as Lewiston. Plus witnessing that grisly incident on board and then having to bring the ship home singlehandedly while babysitting a helpless, demented astronomer. What I need more than anything else right now is a booster shot for my own sanity—like a couple of days of quietly wandering around out there soaking up the atmosphere of good old Earth."

"I understand." Clark hesitated briefly, then added, "But it's possible that some of the others with experiments on the *Archaeopteryx* will hear that she's back and start badgering us for information. And, distasteful as it is, the Foundation will certainly have to have an immediate inquiry to formulate an official report on this business—and a way of handling PR when the news breaks. We should be able to get in touch with you if necessary. Could I persuade you to carry a pocket communicator?"

"Well . . . O.K. But please don't bother me unless it's absolutely necessary."

"We'll do our best. Thanks, Jonel. And in case nobody's mentioned it, welcome home." They left the ship together, crossed a strip of field still clear of all personnel in accord with Turabian's pre-landing stipulations, and stopped in at the Foundation's port office to pick up a communicator. "Take a couple of good days to unwind," Clark told Turabian as he handed him the tiny instrument, "and then we should be able to get everything sorted out in a week or so."

Turabian went out. As soon as he had left, Clark got on the phone to Joe Sanchez, the Foundation's chief counselor, in New York. When he got an answer, he didn't even try to keep the worry out of his voice. "Joe, I'm down at Kennedy Spaceport and we have a real mess on our hands. Can you come down right away and talk it over?"

Turabian went to his quarters, making sure nobody he knew was around, and changed into a tan outfit that he felt sure would be inconspicuous. He did indeed need time to unwind—among other things—and being recognized by tourists, with the resulting celebrity treatment, wasn't the way to do it. He didn't need to worry about intentional publicity, of course—Clark had every incentive to keep his return as quiet as possible, as long as possible. But it was worth a little conscious effort to blend quietly into his surroundings.

He felt a little guilty about not

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letting Sandy know he was back, of course. Once or twice he almost decided to call her, but then stopped himself. He wanted to see her, but it would have to wait. Right now he really needed to be alone, away from everybody else. Even Sandy.

Wearing sunglasses adjusted to their darkest setting, he hopped an uncrowded ground shuttle and rode it to a seaside park he knew a few miles down the coast. It had a narrow mile-long strip of light sandy beach between the ocean and a group of tropical gardens, with enough paths winding among the lush vegetation to provide effective solitude for quite a while. He strolled them slowly, savoring the impressions of Earth that flowed to him through all his senses. The isolation of super-c, and the realization that he was alone with two others over a hundred light-years from all other men, had brought a kind of awesome exhilaration, but being back was a more than welcome change of pace. Out there, there were no sea breezes bringing him that salty smell with the musical accompaniment of breakers on the beach. There was no feel of warm sand underfoot. There were no palms waving against a backdrop of massive white cumulus clouds in a deep blue sky that stretched, wide open, to the horizon.

Yes, he thought with a slight chuckle, remembering space even as he sought to re-attune himself to Earth, *but there are other things. Things that palm trees can't replace any more than they can replace palm trees. I'll be back, someday.*

Gently, he nudged his mind back to Earth. He stayed on the beach for a long time, occasionally wandering to the water's edge but more often using the twisting paths to avoid the park's few other visitors. Gradually he relaxed and began to feel at home.

And then the other thoughts began to surface. O.K.—let them. He would have to face them soon enough, and he wanted to be calm and relaxed when he did. That was why he had come out here.

He had not been entirely candid with Clark, and that bothered him a little. He hadn't told any lies, but he had selected his pieces of truth with care, and he was sufficiently attached to openness and honesty that even that bothered him. He would feel more at ease when everything was out in the open.

Of course I'm going to tell them, he thought defensively, as if answering some accuser inside his head. *I just need time to think it over. Want to make absolutely sure it's the right thing to do.*

Such thoughts, of course, implied doubt. That had been Lewiston's undoing. Doubt. Well, there *was* doubt. It *was* important to be sure he was doing the right thing. But eventually he would have to make

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a decision and live with it, whatever its consequences.

The thoughts began to churn in his mind, goading him toward action. A part of his mind was back aboard the *Archaeopteryx*, hopping from scene to scene, sampling snatches that seemed immeasurably far away and at the same time vivid and urgent.

"Maybe," Lewiston said over and over, each time introducing some scholarly string of qualifiers. "But none of that matters, because there"—he pointed to the screen—"is the reality."

It was starting to come back to me now, and I didn't like it. I asked him about the other indications, and he nodded. "Dangerously?" I asked.

"I'm not sure," he said. "We're not well-instrumented in that area. And I'm not a biologist."

We talked some more. Details blurred; they don't matter. Then I heard Lewiston say, "After all, they have a hundred and thirty years."

"They don't *have a hundred and thirty years," I corrected bluntly, amazed that he would forget the cosine factor. He must really be rattled.*

Turabian's mind snapped back to the present. The sun was getting low beyond the trees to the west, and his wandering thoughts had filled him with a fresh sense of urgency. If he caught a shuttle right away, he could still get into a town and get a few things done tonight.

Let's see, he thought as he turned, checked his pockets, and started with sudden briskness for an exit. *A library, certainly . . . and a doctor . . .*

"Archaeopteryx," Joe Sanchez mused idly, still experimenting to find the most comfortable position for his huge frame in the chair Clark had provided. "Odd name for a ship like that. Any special reason for it?"

"More or less." Clark, seated behind the big steel desk and still unnerved by the whole affair, wished Sanchez would quit beating around the bush. But he knew that was unlikely. Sanchez would come to the point in his own good time, and until then there was nothing to do but go along with him and try to appear patient. "The archaeopteryx was the first bird; its modern namesake is one of the first starships, based on the fundamental breakthrough Rao and Chang made a few years before the turn of the century. But even more than that, from our point of view, the original archaeopteryx was a bird of the past. That's what our ship was supposed to be."

Sanchez, in the process of lighting a cigar, lifted his shaggy eyebrows and blew a cloud of smoke out through his mustache. "And what's that supposed to mean?"

"You haven't been following this? Well, Donald Lewiston heard a couple of remarks in his youth that stuck with him and so I guess

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they're sort of behind this whole project. The first was by a man named John Campbell—back when going to the Moon was big news—to the effect that what astrophysics needed most was not bigger and better telescopes or spectroscopes, but a time machine. Lewiston was one of the first—or at least most vocal—to recognize that the Rao-Chang FTL drive could provide some of the same advantages."

Sanchez looked interested but didn't speak. After a brief pause, Clark went on. "The other remark that influenced Lewiston came from a professor he had as an undergraduate. Do you know what a supernova is?"

Sanchez nodded. "When a star goes *bang?*"

"Right. A bigger-than-average bang. There hasn't been one in our galaxy for centuries, but in 1885 there was one right next door—S Andromedae, in the great spiral galaxy M31. An unusually favorable location for study—except that photographic spectroscopy wasn't well-developed yet. Lewiston's professor's remark was simply that if S Andromedae had been just twenty years later—or a thousandth of a percent farther away—we would now know far more about supernovae than we do."

Sanchez grunted. "And so Lewiston wanted to take this . . . er . . . 'time machine' back to 1885 for a better look?"

"In a manner of speaking. Not in every sense, of course—no meeting Great-grandma as a young girl or anything like that. But the light that came past Earth in 1885 was now a little over a light-century past us, and since the Rao-Chang drive can move much faster than light, it would be a fairly simple matter to go out and overtake it. That way we'd get a look at the same view we missed in 1885. It would even be as bright, for all practical purposes, since a light-century is a very small fraction of the total distance the light traveled."

Sanchez knocked a long ash off his cigar. "A cute idea," he said. "But you said it went out over a hundred light-years. That's a lot farther than any of the other Rao-Chang ships have gone. I'm surprised the Foundation approved it so soon—especially just for one man to go look at one star."

"It almost didn't. The other ships are looking for colony sites; the *Archaeopteryx* was a purely scientific venture, and the Foundation did indeed balk at supporting it. But Lewiston was determined, and despite the popular picture of him as shy and mild, he could be shrewd and even ruthless when he was after a grant. When we made it clear that we wouldn't risk a trip of that length and potential danger just for his supernova spectra, he conned a dozen other influential astronomers and physicists into letting him run experiments for them

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on the same trip. They wouldn't have to go along—the instrumentation could be so automated that the ship needed no crew beyond one pilot, one full-fledged astronomer, and a mate who could double as the astronomer's assistant. So he finally convinced us that the scientific value could be made commensurate with the cost and risk of life." Clark smiled self-consciously. "In fact, some of us had very high hopes for this expedition."

Sanchez took a long draw on his cigar, blew a mediocre smoke ring, and cleared his throat. "I see. And now the expedition's back—with the pilot dead, the astronomer insane, and nobody left to tell about it but the mate."

Clark winced. *Well,* he thought with a sigh, *at least he did finally get back to the point.*

There was an awkward silence while Clark tried to think what to say. Then Sanchez said, in the same musing way he said so many things, "I wonder if it was really wise to let that fellow—Turabian?—wander around with nobody sure where he was going."

Clark blinked, startled. "Why shouldn't he?"

"Well, I gather you didn't question him very thoroughly. I haven't had a chance to question him at all."

"He'll be back." With sudden surprised comprehension, Clark laughed nervously. "Oh, come on, Joe! This *isn't* a murder mystery!"

"Isn't it? I mean, are you sure? I'm not saying you're wrong; I'm not saying our problem is going to be any more than figuring out the most delicate way to tell the world that Lewiston did just what Turabian says he did. But, at this point, is it really so obvious that Turabian's story is true?"

"I don't see—"

"You don't see any clear-cut evidence of exactly what happened, do you? I don't think you will, either. Turabian says they struggled; the bulkhead tool would have had both sets of fingerprints on it, and they've probably both been cleaned off. All I'm saying is that Turabian told you one version of what happened, and there may be others. Which came first, Lewiston's mental breakdown or his alleged killing of the skipper? If the murder came first—and maybe brought on the collapse—did Lewiston *do* it or *witness* it? Whoever did it, *why?* If Lewiston's insanity came first, what precipitated it? No matter how it happened, all those questions need good solid answers before the Foundation can adopt a strong position on this matter. And I don't see how we can get good solid answers when we don't even know where Turabian is."

Clark scowled, simultaneously slightly ashamed that he hadn't thought of the same questions earlier and more than slightly annoyed

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that Sanchez was making such a big deal of Turabian's temporary absence. "You're making a big fuss over nothing," he said. "Look, I know Jonel Turabian. I trust him. There's no problem."

"You're too willing to trust people," Sanchez told him bluntly. He looked really disturbed. "Too willing for your own good. I've often worried about that, Henry. Frankly, you never did know how to use power. You've got to realize that the people you can't trust are going to be very careful to make you think you can—so you don't dare really trust anybody. You've got away with it so far, just dealing with grant applications and such. But maybe someday you're going to find yourself dealing with something more important, and somebody you trust is going to catch you so off guard it'll make your head spin. I just hope now's not the time." He shrugged, but annoyance and frustration were strong in his usually undemonstrative face. "My advice would have been to keep him here until this whole thing's cleared up. But all I can do is advise. I can't make you listen to me. What are you going to do now?"

Clark pressed his lips together and silently studied Sanchez' face for several seconds before answering. Sanchez was being unreasonable, ridiculous. And yet, however slightly, he had managed to erode Clark's certainty that he could trust Jonel. Clark resented that. Finally he said coldly, "Do you want me to get him back here?"

Sanchez' eyebrows rose slightly, very briefly. "Can you?"

"Of course. I asked him to carry a pocket communicator when he left the spaceport. He took it without the slightest hesitation."

"Ah," Sanchez smiled mildly, "but will he *answer* it? I suggest you try him."

There was a phone on the desk. Somewhat apprehensively, Clark punched the code for the communicator he had given Turabian. An intermittent musical hum told him the call was getting through.

But nobody answered. Clark began to sweat with the third buzz, and grew more tense with each later one. He quit after twenty and turned away from the phone, badly shaken. "If it *is* a murder mystery," he asked almost inaudibly, "who has jurisdiction out there?"

"I don't know," Sanchez replied with a shrug. "But I certainly want to talk to somebody—preferably a psychologist—who knew Lewiston before the trip. And Turabian too."

As he worked at his tissue analyzer, Dr. Sidney Marvin kept stealing furtive glances at his unexpected late patient. He felt just the slightest twinge of unprofessional annoyance—it was dark out already, and he had been all set to go home to Cynthia and supper when this young man showed up insisting

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that he had to know right away how much danger he'd been exposed to. He'd tried to convince the man—Jim Koehler, he said his name was—that doing the tests tonight wasn't going to be any better than doing them tomorrow morning. But Koehler had protested that he wouldn't be able to sleep until he knew, and had made enough of a scene that Marvin finally gave in. Now he kept thinking that something in the man's manner didn't quite ring true.

And that he ought to recognize him, even though he was quite sure he knew no Jim Koehler.

He turned away from the big stainless steel box and walked back over to the patient, examining the readouts as he went. "Well, Mr. Koehler, you can relax. There doesn't seem to be any damage, either functional or genetic. I don't think we'll even need to check the crystal dosimeter you brought along."

"Please do," Koehler said at once. "It's possible that I was in a position where something shielded me from most of the radiation. I'd still like to know how bad the general levels got."

"But—"

"Please. You already put the crystal in the evaluator, so it's just a matter of looking at the results. Right?"

Marvin started to argue, then shrugged and walked over to the evaluator. He took out the crystal and the card that lay next to it, containing an automatically printed summary of its indications. He gave the card a perfunctory glance, then did a double take and stared hard and long at it. Finally he said, "Good heavens, Mr. Koehler, you *were* lucky! You haven't been messing around with unlicensed radiation research, have you? That's very dangerous—"

"No," Koehler interrupted, "I haven't. May I see that card, please?" Before Marvin thought to stop him, he scooped up the crystal and the evaluation and stuck them in his pocket.

Marvin realized a little later that he should have insisted on getting the card back immediately. Now all he thought of was to blurt out, "Well, if you haven't been doing unauthorized research, where on Earth did you get exposed to stuff like this?"

Koehler flashed him a quick, odd, almost humorless smile. "Funny you should ask that, but I don't think the answer's really important to your diagnosis. Thanks, Doctor. You've been a big help. I believe you said your fee would be eighteen dollars." He pressed a twenty into Marvin's palm and disappeared through the door.

Five minutes later, Marvin remembered why he had seemed to recognize Koehler. His mouth dropped open, he stopped suddenly with his hand on the doorknob, and after two seconds' hesitation he

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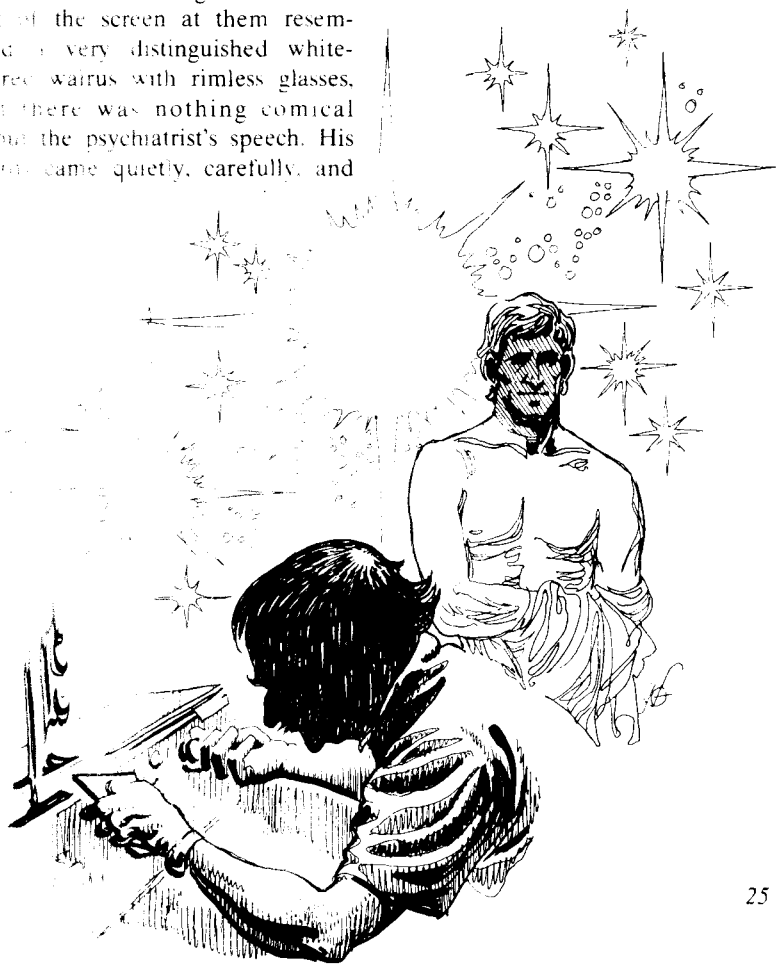
rushed back to the phone and picked it up. "Long distance information, please."

II

Stephan Kovacs was still in New York when they called him the next morning, but Sanchez and Clark agreed that even small nuances might be revealing enough to warrant using a shielded picturephone line. The image that looked out of the screen at them resembled a very distinguished white-haired walrus with rimless glasses, but there was nothing comical about the psychiatrist's speech. His words came quietly, carefully, and trimmed right to the point. "Yes," he said, "Donald Lewiston has been placed under my care."

"And you also handled his original screening examination before he was cleared to supervise the experiments on the *Archaeopteryx?*" Sanchez asked his question without ever moving his eyes from the screen. Clark just listened from the sidelines.

"I did."



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"You got to know his character pretty well?"

"I'd say so."

Sanchez lit his first cigar of the morning, talking off-handedly around it as he did so. "Dr. Kovacs, you've already been told that when Lewiston came back in this condition, the original pilot of the ship was found to have been murdered. This is all very awkward for the Foundation. We're trying to find out exactly what really happened before word gets out and the public starts ad-libbing. So please keep whatever we say under your hat."

"Naturally," said Kovacs, with a hint of impatience.

"The ship's mate, who was the only one aboard in a condition to tell us anything, says Lewiston broke down under strain during the trip and killed the skipper. Does that sound likely?"

"It's quite possible."

"The mate says he often suspected that Lewiston could suffer such a breakdown rather easily. He mentioned Lewiston's usually wearing a characteristic fixed smile, which to him suggested that Lewiston's outward appearance of self-control was maintained by what he described as 'a tight lid that might blow off'. Does that jibe with anything you found in your screening tests?"

Kovacs nodded slightly. "There was an edge there, rather sharp and well-defined. Lewiston knew where it was, though, and did an admirable job of staying back of it."

"But you do think he could have been pushed over?"

"Yes. Under the right circumstances."

"The mate blamed it on the feeling of isolation while they were going faster than light, when the stars are invisible for an extended period. Do you think that could have done it?"

The psychiatrist smiled almost imperceptibly. "Well, I've never actually experienced super-c myself, but I'd have to say no. It would have taken more than that to send Lewiston over the edge, or I never would have O.K.'d him for the trip. It would have taken something more specific—more of a definite shock."

"Hm-m-m." Clark noticed a fleeting expression of *something* on Sanchez' face. Then the counselor continued smoothly, "The ship's mate we're talking about is named Jonel Turabian. Did you screen him also?"

"Yes."

"Is it possible that Turabian himself killed the skipper, witnessing that act triggered Lewiston's collapse, and Turabian took advantage of that to transfer the blame to Lewiston?"

Kovacs looked surprised. "Highly unlikely," he said. "Turabian was quite stable. It would have been very hard to drive him to something like that. He was about as far

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[illegible] no suicidal tendencies as anyone's ever examined. It's a simple matter to run a lie detector test on him if you're in doubt, but I'd bet money on what it'll show."

"You feel pretty sure Lewiston died then?"

Kovacs nodded. "*He* thinks he did. He's in no condition to give us much more information, but I think he's right."

Sanchez thanked him and broke the connection. "Well," he said, turning to Clark, "looks like you were right. It isn't a murder mystery." Clark had already started to feel relieved, but Sanchez immediately added, "It may be something much worse."

The smile Clark had started to form dissolved. "What?"

"According to Kovacs, Lewiston did just what Turabian said he did. *Except* that what sent him over the brink was something more than just the isolation in super-c. So what was it?"

Clark's jaw dropped slowly as he grasped Sanchez' point. Something must have happened out there. Something drastic enough that it drove Lewiston insane and Turabian didn't want to talk about it.

What?

"I think," Sanchez said earnestly, "it may be important. I think we'd better try again to get Turabian back here as soon as possible and find out what happened that he's covering up. Want to try his communicator again?"

Clark nodded unenthusiastically. Fearing the same response—or non-response—as before, he reached for the phone.

And it rang.

He picked it up, startled. "Hello? Henry Clark here."

It was the Foundation office in New York. "Mr. Clark," said a smooth-voiced young lady, "we had an odd phone call last night, from a small town somewhere down there—Wabasso, I think it was. An M.D. named Marvin said he'd just had a patient who was acting strangely and was concerned about some radiation he'd supposedly been exposed to. He didn't show any body damage, but he brought along a crystal dosimeter that showed definitely alarming levels. And—get this—after the man had gone, this Marvin thought he recognized him as one of our Rao-Chang crewmen. Description sounded like Jonel Turabian. Is that possible?"

"We'll look into it," Clark said. "Anything else?"

There wasn't. As soon as that connection broke, Clark punched out Turabian's code as fast as he could. He felt tremendous relief when, after the first buzz, Turabian's voice said softly, "Yes?"

"Jonel!" Clark said with audible surprise. "You had us worried. Why didn't you answer when I tried to call you last night?"

"I was with somebody, and you wanted me to be inconspicuous,

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didn't you? So I thought it would be best to ignore the communicator right then."

"O.K. Was the somebody you were with a doctor?"

Turabian sounded startled. "How did you know that?"

"Never mind that now. Joe Sanchez came down from New York, and we need to talk to you right away. Where are you?"

"Public library and computer terminal in Palm Beach."

"That'll keep. We'd like you back here as soon as possible."

"Can you give me another hour or two? I need some more information and—"

"You can get it later. Please, Jonel—*now.*"

Reluctantly: "O.K. Be there shortly. Maybe I can take some of this with me and read it on the way. So long."

As Clark hung up, he frowned. *Now what,* he wondered, *can be so all-fired urgent about a public library?*

Turabian arrived early in the afternoon, which was quite reasonable, but Clark's cordiality was strained as he welcomed him back and led him into the small conference room he and Sanchez had appropriated. As soon as they were all seated, around a small oval table with a magic slate top, Clark said bluntly, "You've been holding out on us, Jonel. We talked to the psychiatrist who dealt with Lewiston both before and after your trip, and he says Lewiston wouldn't have cracked the way he did just from spending time in super-c. He says something else must have happened. Then we find out that in your first few hours back on Earth you've gone to a private doctor under a phony name with a worry about radiation dosage. Something's very fishy here, Jonel. What is it? What happened out there?"

He was prepared to meet resistance, but Turabian simply nodded, thoroughly unruffled, and said, "You're right." It seemed to Clark, somehow, that he looked disturbingly calm and solemn. "I have been holding out, and I'm sorry. But I'm ready to tell you about it now. It's important and it'll take a little while, so make yourselves comfortable and listen closely." He glanced from Clark to Sanchez and back again, as if waiting. Clark, feeling fidgety, made a determined effort to look relaxed and attentive. Finally Turabian asked, "Do you know what a Seyfert galaxy is?"

Clark searched his memory for the term. Sanchez said, "I don't."

"Neither does anybody else, really," said Turabian. "We've only seen a few, and those from great distances, so we don't know much about them. We know they're spiral galaxies like ours, and they have small bright nuclei—or small bright regions in their nuclei—and peculiar spectra with strong emission lines and a lot of Doppler

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broadening. Some of them are strong radio sources. Some people have thought they may be important sources of high-energy cosmic rays. But nobody's sure what the mechanism is, except that it seems to be some kind of explosion involving the nucleus as a whole. Possibly a chain reaction of supernovae—or maybe something else, but that at least helps you picture the order of magnitude. Imagine tens of thousands of things like S Andromedae occurring in a few years in a small region of space, and you may get some of the right idea."

Clark squirmed uncomfortably in his chair. What was the man driving at?

Turabian continued, but changed his tack. "Now, consider this. We liked to think of the *Archaeopteryx* as going into the past—by running after the light from S Andromedae, we reached a point where we were seeing things on that side of the sky as Earth had seen them in the past. Not all at the same time in the past—the exact amount depended on direction, from practically zero for distant objects straight out to the sides up to a hundred and thirty years for things straight back—but all in the past. But at the same time, and in just as real a sense, we had moved into other parts of Earth's *future*. We had moved *closer* to objects on this side of the sky, and so were seeing them by light that wouldn't reach

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Earth for quite some time yet.

"The center of our galaxy was about sixty degrees from our forward direction on the *Archaeopteryx*. Not straight ahead, but definitely in the 'future' half of our sky. And that's where we saw the anomaly."

Clark frowned. "What anomaly?"

"A bright spot that nobody'd ever seen before. Nobody's ever seen the galactic center, you know, although we've known where it is for some time. It's thirty thousand light-years off and hidden behind thick clouds of interstellar smog. But *we* saw it, right through all that stuff. And that means it was bright."

Clark felt a chill trying to start up his spine. Sanchez said, "Are you trying to say our galaxy's going to become one of those Seyfert things?"

"I'm saying it already has. It happened some thirty thousand years ago; the light and radiation just hasn't reached us yet. But we've seen it coming. It has the right kind of spectrum, and it's coming from a point quite far off in the right direction. It'll get here."

"O.K.," Sanchez said quietly. "When?"

"A very pertinent question," Turabian nodded. "We weren't in a position to fully evaluate the danger, what with limited cosmic ray instrumentation, medical knowledge, pertinent references in the ship's computer memory, and time. But we did find references indicating that radiation levels in an exploding galaxy could get high enough to wipe out life-forms on planets all over the galaxy. So we rigged a dosimeter on the ship's exterior to get data that could be analyzed later to give us an idea what Earth was going to be up against. And then we started home—jumping in and out of super-c several times to look at the explosion from various distances and find out when it starts."

This is crazy, Clark thought. *He's talking seriously about the center of our galaxy exploding and destroying life on thousands of planets including this one—and it seems so far from reality that I don't* feel *anything at all about it. Nothing.* But slowly, insidiously, the feeling was starting to build up.

He heard Sanchez say, "And what did you find? I take it a hundred and thirty years was an upper limit—"

"Sixty-five years was an upper limit," Turabian corrected. "There's a cosine factor in it because we hadn't traveled straight toward the galactic center." He quickly sketched the geometry on the tabletop. "Lewiston forgot it, too—and when he forgot something as basic as that, I knew he was really upset. The minute he first realized the bright spot was toward the galactic center was the first time I ever saw him lose his grin, and he was never

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the same after that. When we started hopping home, he looked up everything the computer had on Seyfert galaxies, and he worried. Sometimes he got obsessed with the idea that we must stop wasting time and get the warning home as fast as possible. Other times he thought we shouldn't deliver it at all because there wasn't really any danger and warning Earth would achieve nothing but unnecessary terror. And at still others he thought we shouldn't deliver it because the danger was real and so bad that nothing could be done—so a quiet finish would be better than spending our last days worrying about the inevitable.

"More and more, during the long days in super-c, he took to sitting silently and morosely in a corner, never speaking except for occasional spells of hallucinations and raving on one of those themes. One of those times was when he attacked Dirk. I think he had all three of his ideas tormenting him at once that time. He struck with amazing speed and strength; I couldn't stop him in time. I don't think he even understood what he'd done afterward. All I could do was keep him tied up, sedated, and led the rest of the way home.

"I only dropped below c once after that. The added strain of running the ship and taking care of Lewiston was getting to me, and besides there was a risk of getting stranded if I tried any more intermediate looks. So we came on in after that one. The thing in the nucleus was weaker that time, so I guess we were near the beginning, but it was still there."

Clark shuddered. It was starting to feel more real now—about as real as the mid-morning memory of a vivid nightmare. "So," he asked, "how long do we have?"

"At most," said Turabian, "twenty years."

III

Something unpleasant caught in Clark's throat. "Why didn't you tell us this right away?" he rasped.

"I wasn't sure it was wise," Turabian said simply. "Frankly, I was a little afraid one of Lewiston's worries might be right. In particular, I thought maybe he was right that there was dire danger and nothing to be done. You'll certainly recognize that, whether right or wrong, announcing this would have impact. Panic . . . despair . . ."

Yes, Clark thought bitterly as the reality continued to burrow into his mind, *certainly despair. How cruelly ironic that the Rao-Chang drive should give man access to the stars—and then show him an impending threat from which even those stars can provide no refuge.*

"If that was the case," Turabian was saying, "I thought it would be wrong to mention it. Once the cat was out of the bag, there'd be no way to get it back in. So I had to find out first how great the danger

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was. I buried our observations of the explosion in the computer, stored under a key word known only to me—don't worry, I'll give it to you now—and I sneaked out of the ship with the crystal dosimeter we planted outside in my pocket. I took that to Dr. Marvin last night, and went to the library to check some things our ship's computer didn't know."

"And?"

"Lewiston was right. The danger is very real. The ship protected me, but out in the open I would have been in bad shape."

Clark felt an irrational flash of resentment. Sanchez asked the question that was in both their minds. "Then why are you telling us now?"

"Because," said Turabian, "he was wrong about there being nothing that could be done."

Another feeling surged up in Clark. He jumped on the words. "What can possibly be done?"

"It's possible to hide," Turabian said. "Not pleasant, but possible. And probably not even that without large loss of life. But at least some can take their lives and their civilization underground during the part of the day when the radiation's bad. It'll mean big changes. For instance, the bad part of the day won't coincide neatly with either daytime or night, and it will change with season, and surface farming will be out. But it can be done—I think."

"Oh," said Clark. He was disappointed; he had hoped for a more pleasant way out. "How long will such measures be necessary?"

"It will seem like forever. Quite possibly a million years or so." He paused; neither Clark nor Sanchez said anything. Finally Turabian added quietly, "The other way—for some—is to migrate."

"*Migrate?*" Clark and Sanchez gasped in unison. Simultaneously, Clark said, "Where?" and Sanchez said, "I thought you said it affected the whole galaxy—"

"Uh-huh. I also did some research on the Rao-Chang drive when I was in the library. You know we used a top speed of 1,000c or so on all the runs we've made so far. Do you know why?"

"Why, I suppose . . ." Clark fumbled for an answer. He didn't actually know, but it was embarrassing to admit that.

"I suppose it's as fast as they can go," Sanchez offered.

"No," said Turabian, "it isn't. It's *not* an intrinsic limitation on the Rao-Chang drive. We don't *know* of any intrinsic limitation on the Rao-Chang drive—except that it accelerates so *easily* when you get much past c that the navigation would be too tricky on trips as short as we've done so far. Like trying to go to the corner drugstore at six hundred miles per hour. But if you start talking *intergalactic* travel . . ." Surprisingly, he smiled.

And the smile grated on Clark's

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sensibilities. "Intergalactic?" he echoed incredulously, annoyed. "It's too far!"

Is it? Why? The only reason I know is that it's so far beyond what we've done before that we hadn't felt ready to consider it yet. But sometimes a good kick in the pants can get a man to try something he never dreamed he could do, and he finds that he can. As far as I'm concerned, my galaxy exploding is a *dandy* kick in the pants."

Clark's head spun, trying to assimilate it all. First being told that this galaxy was exploding, then that a possible solution was to leave it altogether.

For a moment he almost succumbed to the inviting optimism in Turabian's smile. Then sudden counter reaction set in and he shook his head vigorously and slapped his hand down on the tabletop with a startling *bang*. "No," he said stubbornly. "It's no good. No good at all."

Turabian looked at him oddly. "What's no good?"

"Your idea. I'm sorry, Jonel, but I can't buy it. Have you really thought about what you're saying? I mean, suppose it's true. Suppose Rao-Chang ships can make intergalactic trips. How many people can they take?"

"I can't give you any numbers. I never pretended it would be a neat way out for everybody."

"You bet it isn't! Nobody's thought about building a really large-scale transport yet, but I can't imagine anything that would begin to make a dent in the population. The *Archaeopteryx* only carried three men, but that was special. O.K. The colony ships carried a few dozen. They're far cheaper than we ever dreamed interstellar travel could be, but they're still damned expensive. So when you sit there spouting glowing chatter about this thing spurring us on to bigger and better things, you're really talking about a tiny elite going off at the expense of the rest of us. Sure, *you* might be one of the elite, but what about *us*, Jonel? All of us who have to stay here and die, or curl up and hide and know that more generations than we can picture are going to have to do the same? While you go merrily off to the Magellanic Clouds or—" He stopped abruptly as he realized what he was doing. He hadn't even realized, when he started the tirade, that Turabian's attitude had got to him so much—or that there was so much personal resentment in his reactions. But it was true. If Jonel's idea were accepted, who would decide how many went, and who they would be? It would be a sticky question. However it was done, it was likely that Jonel would go—and even more likely, even unto certainty, that Clark wouldn't. It bothered him more than he liked to admit, and it would bother billions of

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others who were in the same boat and far less able to accept it.

And *he* would have to deal with all of *them.*

That threat was a lot closer and easier to visualize than the explosion itself—and therefore, in its way, more immediately appalling. With a conscious effort, he restored some calm to his mind. But he made no apologies.

He heard Sanchez put into words a faint hope that was in the back of his own mind. "Let's all hold onto our hats here. How sure are you that the situation's really as bad as you've sized it up? You're sure this thing's really a *core* explosion and not something else?"

Turabian nodded; Clark thought he looked slightly shaken, but it was hard to be sure. "I don't see how it could be anything else. When you check the stuff I left in the ship's computer, I think you'll agree."

Sanchez grunted. "We'll see. O.K., suppose we take that for granted. How sure are you of the radiation hazard? You base your appraisal of that on a dosimeter you planted on the outside of the hull and had a small-town Florida doctor evaluate. Are you sure he knew what he was doing? I mean, the place where you had the dosimeter wasn't exactly equivalent to the surface of the Earth."

"I'm sure he *didn't* know what he was doing," said Turabian. "But I didn't just take his word for it. I got the analysis card from him and went over it myself, making all the corrections I could. It will be dangerous when it gets here."

"But," Clark objected, "you said the ship protected you. Why won't the atmosphere and the geomagnetic field protect us?"

"They will, to some extent—but not enough. Remember two things. First, a starship necessarily has a good deal of radiation protection built into it. Second, even if the intensity's low enough so it doesn't bother you in a few hours or days, it might still be disastrous if you get a continuous blast of it for your whole life. That's what we're going to be up against—for fifty thousand generations. I came off the *Archaeopteryx* with no serious damage, but I wouldn't have wanted to stay out there for very long. I was concerned enough to have a thorough tissue check at the same time I had the dosimeter read. I was lucky."

Clark sucked in a deep breath. They were grasping at straws, he knew, but it was better to do that than to pass hastily by things which appeared to be straws but were really more substantial.

O.K. The straws had been tested and found wanting. Now what?

He thought through a long silence, but no answers came. Finally he said, "I didn't mean to snap at you, Jonel. You'll understand that this is a bit of a shock to me. I'll need some time to get my balance. But I can tell you one thing right

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off. I can't accept the solutions you've suggested until I've really dug for something a lot better."

"Do you have any idea where to dig?"

"None. But it has to be done. Surely there's a way we can help more people than that—and I've got to find it. Can I count on you to help me?"

Turabian looked at him for several seconds before he answered, and Clark failed utterly to read what he was thinking. Then he said "Sure. And good luck. Do you have anything for me to do now?"

"Not right now. I have to get my thinking started first. There must be places and people you've been wanting to see since you got back. Why don't you go ahead? If you'll hang on to that communicator, I can call you when I get an idea."

Turabian stood up. "Will do. The key word for the records in the computer is 'syzygy'; I guess you'll want to start there." He started toward the door.

"Thanks." In time, Clark remembered to add. "Please remember, all this is still in an awkward state. We're not trying to hide the fact that you're back, but we'll be trusting you to keep quiet about all of the details. Things like what happened to Dirk and Lewiston, and the core explosion business . . ."

Turabian stopped halfway to the door and nodded. "Sure, I understand. And you'll understand when I say I'll have to make one exception."

Clark started to react with shocked anger, but it dissolved into a relieved smile—the first time he had smiled in what felt like a long, long time—as his mind snapped back to normality enough to catch Turabian's meaning. "Sandy?" Turabian nodded. "Sure," Clark said, still smiling, "I'll understand that. Just make sure *she* understands. And give her my best. Have a good trip."

Turabian went out. As the door closed behind him, the mental image that had prompted Clark to smile projected itself twenty years into the future and the smile vanished as abruptly as it had come.

Clark felt very much as if a great weight had just descended on him and there was no one around to take it off.

He sat silent for a long time that was probably actually no more than a minute. He gradually became conscious of the fact that Sanchez, retained by the World Science Foundation as "chief counselor," hadn't been doing much counseling in the last few minutes. "Well," he said suddenly, in a tone that might be construed as accusing, "what do you think about all this?"

Sanchez shrugged. "I think I'd better not form an opinion until I know more and have time to put it in perspective."

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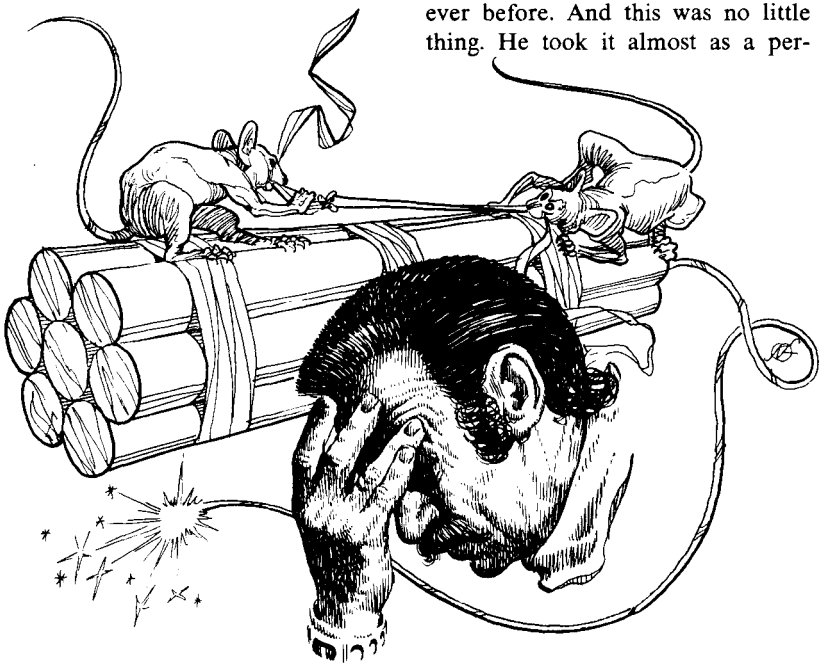
"No bright ideas about what to do?"

"Not yet. I'd say start by going over everything the *Archaeopteryx* has filed under 'syzygy' with a fine-toothed comb. Make absolutely sure the problem's really what he claims it is before we put too much effort into a solution."

"And if it is?"

"Then we're going to have to put an effort into it that makes the mind boggle. And I still wouldn't bet on finding a solution we like. I'm afraid this one may be *too* big." He pushed himself away from the table and stood up suddenly. "I think we both need some time to think before we do much more talking. You know where you can call me." When Clark said nothing, he went out and eased the door shut behind him. A moment later he stuck his head back in and added, "Assuming that *is* the problem, I can think of one man it might be a good idea to talk to." Then he left again, and this time he didn't return.

Clark stayed where he was for half an hour, letting his mind wander over what he'd heard, urging it to calm down and steady itself onto a course of action. Occasionally he picked up a stylus and doodled absently on the magic slate tabletop, then immediately rubbed out the doodles, annoyed with himself. Lately—it had been building up since Dianne had died, almost two years ago—he had seemed to himself more indecisive and more easily irritated by little things than ever before. And this was no little thing. He took it almost as a per-



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sonal affront that it should be dumped in his lap. He liked his job, for the most part, but he would never have taken it if he could have foreseen that it would include this kind of thing.

Why me? he thought miserably. Then he managed to force that kind of thinking out of his mind.

And a half hour after Sanchez had left, the meaning of his parting words suddenly penetrated. With a new surge of muted excitement, Clark reached for the telephone.

This may be a straw too, he thought as he punched for long distance. *but it's worth a try. And it's something I can do right now.*

IV

It was still fairly early morning when Turabian turned off the mainway near Knoxville and headed east, following a branching sequence of progressively smaller and less luxurious roads. As soon as he was decisively out of the metropolitan area he took over manual control of the car, enjoying the feel of personally guiding it around the bends and dips and rises. As he wound up into the foothills, he passed through areas where houses were still scarce and trees in their October prime crowded in on the road as if to form a tunnel. In others he skirted open fields from which the brilliant golds and reds formed a plush carpet over distant rolling hills. Either way, it was exhilarating, seen through air as clear as he could remember and sparkling under a cloudless, hazeless sky. This was Earth at its best, almost as if making a special effort to welcome him back.

His last turn took him down a narrow dirt road reinforced with a halfhearted scattering of gravel and bordered with a tall fringe of goldenrod. Two miles down that, an even narrower driveway swung off to the right around the end of an ancient split-rail fence and climbed steeply through a grove of walnuts and hickories, but Turabian didn't turn off there. Instead he pulled off the road, parked on the grass alongside the fence, and went up on foot. As soon as he got out of the car, clean cool air filled his nostrils with the smell of moist mountain soil and fallen leaves, and the leaves crackled underfoot as he went up the short slope.

The house, a little stone cottage that must be close to a hundred years old, stood on a relatively level grassy shelf looking out over the treetops across a succession of ridges and valleys culminating in the main range of mountains proper. Sandy Dunbar, despite her urban upbringing (or maybe in direct reaction to it; even she wasn't sure which), had fallen in love with it shortly before she fell in love with Jonel. When she found how cheaply she could buy it, she had moved in immediately.

She was home. Her jeep was

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parked under its shelter roof, a wisp of smoke floated lazily from the chimney, and—most conclusively of all—Ozymandias the Mutt was home and came running gleefully at Jonel's approach. Oz never wasted energy barking; he was a dog of action, not words. Jonel greeted him with just enough roughhousing so he wouldn't feel forgotten, then made it clear that he would have to wait for more. Oz accepted the verdict, but hung around with wagging tail while Jonel knocked and waited.

He didn't have to wait long. Sandy opened the door and registered immediate surprise. Before she could say anything, Jonel grinned at her and recited softly:

"Home is the sailor, home from the stars,

"And the huntress still home on the—"

"You're ad-libbing," she chided, echoing his grin. Before he could finish, she stopped him with a long, simply affectionate kiss. Jonel made no attempt to finish the poem. Eventually Sandy backed up about two inches and said, "But I'm really glad to see you."

To Jonel, experienced in reading the sometimes subtle nuances of her face, it was obvious that that was the weakest possible statement of her feelings. She had been worried—as well she might, with the extra time the trip had taken. "I'm really glad to see you, too," he said, and kissed her again.

Finally she said, "I didn't even know the *Archaeopteryx* was back. I was starting to get worried. We were expecting you . . . gee, how long? Two weeks ago?"

"Something like that. We had—" he hesitated slightly, "a little trouble on the ship. I'm sorry I didn't call to let you know I'd be late, but the faster-than-light telephone hasn't been invented yet."

She laughed. "That's O.K. You're back now. What kind of trouble was it?"

"I'll tell you . . . later. O.K.?"

For a split-second she seemed to have read some of the seriousness of the trouble, and to register concern about it. But she understood at once, and that fleeting reaction—so fleeting that even Jonel wasn't quite sure it was real—was swept aside at once. "O.K.," she said cheerfully, grabbing his hand and turning. "Come on in. I've got a bottle of champagne I was saving for when you got back."

He followed her into the house, automatically checking his memory-image against her actual appearance. Nobody had ever accused her of being excessively pretty, but it had never occurred to either of them that any importance might be attached to that. She was twenty-six—five years younger than Jonel—and looked neither younger nor older. She could be described as fairly tall and slightly lanky, dressed at the moment in blue

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jeans and a red and white checked flannel shirt, with long brown hair falling straight down over her shoulders. A combination of bright eyes, a slightly sharp nose and an easily triggered good-humored smile gave her face a slightly pixyish appearance, but Jonel had learned to see much more than that in it.

She paused inside and let her eyes dart around the small living room, as if looking for something. The place was not a display of model housekeeping. It was clean enough for health purposes, but not immaculate, and fascinatingly disorderly. Books and magazines filled a set of shelves at one end, but others were scattered here and there on desks and sofas and record cabinets. An oboe lay uncased on the desk and a guitar stood in one corner; a typewriter stood in another, with paper in it. Doors opened onto a kitchen with utensils on the table, a bedroom with an unmade bed, and a photographic darkroom in which water was running. It was, in short, the house of somebody too busy living in it to have much time for appearances.

Except for the pictures all over the walls, and those were what Sandy was looking at—a varied selection of her own sketches, paintings, and photographs, except for a few scenic photos Jonel had given her. Jonel scanned them too; both their eyes stopped on the same one at the same time. He started to comment that it was new, but she spoke first. "You haven't seen this one; I did it while you were gone. You like?"

"I like," he said immediately. This one was a photograph, a most striking photograph made with a split-field lens and showing a mountain sunrise viewed from ground level between dew-covered blades of grass on a nearby bald. "Exquisite. Have you sold it yet?"

She shook her head. "No, I had a hunch you might especially like it, so I was saving it as a welcome-home present for you. If you want me to publish it too, I'll try, but I don't have to. I've sold a few pictures and a children's story since I saw you last, so I'm still eating." She grinned. "It's going to be kind of a relief to stop having to think about being commercial so often after we're married, though. I'm glad that's not very far off."

"Me, too," he said, stubbornly refusing to think about the things he was going to have to tell her this afternoon. He looked back at the picture of the grassy bald. "That's a nice place," he mused. "Why don't we hike up there and gawk at it for a while?"

"Sure. But we have to sample your champagne first." She giggled. "I had the makings for a special meal, too, but they wouldn't keep this long. So would you like a hamburger with your champagne?"

"You're ad-libbing," he observed,

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"but hamburgers and champagne just happen to be one of my very favorite lunches."

There was another primitive road that went fairly close to the unnamed bald in Sandy's picture. Because of their late start, they drove her jeep along that as far as a little-used trailhead before taking off on foot. That left them two and a half fairly rugged miles, with a net altitude gain of fifteen hundred feet—a good trip for an invigorating but unhurried afternoon. Jonel was a little out of shape from the long weeks of relative inactivity aboard the ship, but not enough to make it really hard—and the mountains were in his blood. It was near here, and on a day remarkably similar to this one, that he and Sandy had originally met. They had both been out for late-season solo trips on the Appalachian Trail, up on the main ridge-crest, she heading north and he south. That stretch of trail was little used in that season, and solitude readily available along it, but the day's last sunlight found Jonel and Sandy converging on the same lean-to. They both moved in, pooled their suppers, and then, curled in down sleeping bags, talked well into the night with that relaxed ease characteristic of either old friends or back-packers meeting on trails. By morning he had decided to reverse his trip and head back north, if she didn't mind having a companion, and she decided that she didn't mind at all. A month later they were officially engaged, and she was not in the least bothered by the fact that he was already in training for the voyage of the *Archaeopteryx*.

Now, after the Old Bird had gone and returned, Jonel approached the top of this trail with a curious mixture of nostalgia and mild fatigue. He knew when they were almost there; he had been here before and recognized the tangle of rhododendron and laurel that bordered the bald itself. He felt the climb just enough to react by quickening his pace to hurry into the open meadow and then immediately stretching out on his back in the long, soft grass. Seconds later, Sandy tossed off her small day pack and flopped down next to him. For at least two minutes they wordlessly soaked in the view of wildly colored fluff undulating vigorously far into North Carolina. Nobody really knows what causes the treeless mountaintops called "balds," common in the southern Appalachians, but many are grateful for whatever it was.

Finally Jonel said, "Nice neighborhood you've got here. Suppertime?" Sandy chuckled and got out the food she'd brought—a small smoked cheese, a bag of her own special gorp, and a small wineskin into which she'd smuggled the rest of the champagne when Jonel wasn't looking. As they ate and talked of pleasant matters, Jonel

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relaxed more completely than he had managed at any time since he'd got back to Earth. For the moment, he almost forgot . . .

And then, when they were finished eating and Sandy was packing the few pieces of garbage to carry home, she asked, with deliberate gentleness, "Are you ready to tell me what went wrong on the ship?"

He hesitated briefly before he started. He wasn't going to hold anything back, of course, but he wanted to be very careful about how he told her. Some ways would be worse than others . . .

"Yes," he said. "First of all, let me warn you that Henry Clark—he said to tell you howdy for him, by the way, so howdy—Henry Clark doesn't want any of this being spread around yet. And I think he's right, at least for the time being. So I can tell you, but I'll have to ask you not to even drop any hints to anybody else. O.K.?"

She nodded, frowning slightly. "Of course."

Jonel paused again, then said, "We'd finished everything we went out for, and we were coming home. And Lewiston cracked up. We could see his sanity disintegrating, but neither of us ever suspected he was homicidal—until he killed Dirk."

"Oh, no!"

"Yes."

"But . . . why?"

Jonel shrugged. "*He* may have thought he had a reason, but I don't know what it might have been. Like I said, he cracked up." *No,* Jonel thought, annoyed with himself. *That's not quite right. This isn't coming out the way I want it to.* But right now he didn't see quite how to fix it. He went on, "He seemed harmless because he was mostly very withdrawn. Sometimes he talked about things that were bothering him, but it was hard to see what Dirk or I had to do with them. Though with hindsight, I guess maybe we should have suspected him of being potentially dangerous. Because he did sometimes have raving spells when he seemed to be hallucinating."

"Oh? What kind of hallucinations did he have?"

"He was usually pretty incoherent, so I can't really say much about that. But apparently one recurrent one involved being chased by demons or something. I remember him yelling out several times, 'They're following us, they're following us!' " He paused and admitted, "He got pretty persuasive at times, even when he wasn't making sense. Sometimes there was something about the way he said it that was just plain eerie. Sometimes we had to just tune him out to keep from half-believing it ourselves."

Sandy pursed her lips thoughtfully. "Odd," she murmured, "really odd. Let me get the picture,

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now. Lewiston went crazy and killed Dirk, so you had to keep him under control and bring the ship home by yourself, and that's why it took you longer than it was supposed to."

"Yes. That is—"

"I still don't see why it took *so* long . . ." She frowned, shook her head, and backtracked. "What do you suppose caused him to do that? Lewiston, I mean."

"I don't *suppose*," Jonel sighed. "I know."

She looked at him with sudden surprise, waiting.

"You've gotten into astronomy, haven't you?" he asked. She nodded. Jonel had remembered correctly that she had become intrigued when exposed to it in college—and then later so disappointed with what her professors did with it that she gave up on formal courses in it. She had had similar experiences with a wide range of fields in two and a half years, but she had learned more about many of them after dropping out than many students did by staying in school. Jonel didn't remember just how deeply she'd gone into this one, but he didn't ask; if she needed to ask questions, she wouldn't hesitate.

"Remember Seyfert galaxies?" he said. "The ones with explosions involving the whole core? Well, our trip took us closer to the core of our galaxy, and we discovered that that's happened right here at home." He watched her closely for reaction. She showed surprisingly little except to wait very attentively for more. He wondered whether she had somehow missed the point. "Our galaxy has suffered a core explosion. The radiation could wipe out life all over the galaxy. It'll reach us in less than twenty years." Pause. "That's why I'm so late. We dropped below light-speed several times to look at it from other viewpoints, to get an idea how much time we have. Twenty years—at most."

He looked at her. Still no reaction. Wasn't he getting through to her at all? He reached out and touched her chin. "Sandy . . . did you understand what I just said?"

She nodded. "Uh-huh."

"And?"

"I'm numb. It's too big to get my emotional teeth into." She smiled thinly. "Let me see now. The Earth is going to become uninhabitable in a few years, and so are all the places we might escape to."

"Not quite—on both counts. A lot of people . . . and other things . . . are going to die. I don't see any way to avoid that. But some can probably survive by going into hiding underground. And some may be able to escape by leaving the galaxy. Out between galaxies, we could run Rao-Chang ships a lot faster than we've done so far. So some people—hardy, adventurous types—just might be able to make it to another one and find a

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new home there." He paused for a long time watching her face closely. Then he said, "You see what I'm building up to?"

She nodded, her lower lip caught lightly between her teeth. "I think so. And that I *can* get my emotional teeth into. The future *we* had mapped out—you and I—isn't going to happen."

He nodded and managed a philosophical chuckle. "One of the occupational hazards of trying to map futures. O.K., that one's out; no use crying over it. The question is—you see the question that's bothering me, don't you?"

"What do we put in its place?"

"That's the one."

She smiled her very characteristic smile. "Where will we go?" she asked quietly.

More tension than Jonel realized had built up in him relaxed when she said that. He reached out and touched her hand. "Thanks, Sandy. That takes a big load off my mind. You don't mind being a frontier wife and mother?"

"You know me better than that. Where? The Magellanic Clouds?"

"I don't think so. They're the obvious first choice, being the closest neighbor galaxies. But they're irregulars. Different kind of stellar population and interstellar medium than we're used to. They might be O.K., but I suspect we'll have better luck hunting for the kind of planets we need in M31. That's only two million light-years away." He chuckled, beginning to feel better. "Besides, I think I'd miss the Milky Way if I went to an irregular galaxy."

"So would I. 'Only two million light-years.' That has an interesting ring to it."

"Yes. And a little scary, when you start to *realize* it. Incidentally, we'd better not start thinking of *that* as our new future yet, either. Physically, it can be done; politically, it may be something else."

"How's that?"

"Clark's reaction when I mentioned this kind of surprised me, but it's a good preview of what we can expect. When I suggested that a few people might be able to escape, he was so bitter, automatically, that it even surprised him—and he's over sixty and has a lot more intelligence and self-control than most of the population. We'd just better bear in mind that if something like this reaches the planning stage, there's going to be plenty of heat generated under collars about who gets to go and who doesn't. Maybe even enough so nobody gets to go."

"Oh." Sandy shrugged. "Well, if that happens, then I guess we'll just have to make the most of the time we have left here, won't we?" She finished the sentence with an air of finishing today's chapter of the discussion, and Jonel chose not to pursue it. Sandy looked up at the sky and said casually, "Look where

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the sun is. We probably ought to start down."

Stretching lazily, they stood up. Jonel got the day pack and they headed down through the rhododendrons. The afternoon continued with neither any further mention of the danger nor any feeling of tension brought on by deliberately avoiding it. It continued, in fact, just like an ordinary pleasant afternoon's hike in the mountains. The core explosion had become simply one more item which they both knew and would deal with when the time came. And for her ability to do that, Jonel's admiration for Sandy climbed another notch.

But later, as they sat watching the gold-hued sunset from a rock outcropping not far above the place where her jeep was parked, he noticed that she seemed to become very pensive. "Something wrong?" he asked.

"I was just thinking about two things," she said. "One of them is all the people who can't escape."

"And the other?"

She smiled quasi-apologetically. "It seems silly, really. Though sometimes hunches do have something to them. Maybe they come from subconscious thought, or extrasensory inputs, or . . ."

He nodded, understanding. "Intuition" was little understood, but he would be the last to deny that it sometimes had unique value. "What is it?"

"I keep wondering," she said, "why Lewiston should have kept thinking you were being followed."

V

Henry Clark had had no previous personal dealings with Chandragupta Rao, but he was well aware that in recent years the renowned physicist had become noted for his bitterness toward the Foundation—and, it sometimes seemed, toward the world at large. The reasons weren't clear to Clark—Rao had had a couple of grants turned down, but so had many others including several of comparable stature—but the fact was well known. It didn't matter, because Chang Pei-Fu had died in an automobile accident twelve years ago, so that now only Rao remained. He had been reluctant to grant the interview, but had finally given in after the most determined persuasive effort Clark had ever made.

He faced Clark across a huge wood-textured desk that drew excessive attention to his slight build. Behind him, the morning-lit Sangre de Cristo mountains loomed over his shoulder, adding to the impression. The bushy black hair framing his swarthy face was already graying in streaks, in a way that made him look much older than fifty. But the gaze that riveted Clark, from small black eyes set under craggy ridges, was still as utterly penetrating and disquieting as Clark had ever seen it in pictures.

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[illegible] after his visit [illegible] a short Rao [illegible] their way. Then he [illegible] jingly mild [illegible] [illegible] seem comic [illegible] Brevity is the [illegible] good things," he told [illegible] Therefore I will be blunt. [illegible] you come to me?"

"[illegible] question," said Clark [illegible] the interview without re- [illegible] reason had [illegible] broadest part, but impor- [illegible] slower the gossip spread, [illegible] Miranda Borowski's fu- [illegible] spread it more than [illegible] enough fortunately, the [illegible] had few relatives or friends. The need for caution was [illegible] past. "I sought you out as the foremost authority on the Rao-Clark drive."

Rao laughed aloud, harshly. "Bravo, Mr. Clark, hardly. Pei-Fu and I stumbled onto the technique, that is all. Sometimes I regret it. It seems to have taken all of science in directions quite contrary to what we had intended."

Clark lifted his eyebrows slightly. He hadn't expected this, but he could see potential advantage in listening for a while. "Oh? What do you mean?"

"Consider, Mr. Clark, consider. What were my late colleague and I seeking? A more perfect *understanding* of the universe. And what has been the effect of our accidental discovery of the paratachyonic drive? Theoretical physics is in a shambles and getting worse instead [illegible] We can *use* the drive, but we don't understand it. The very [illegible] of theory need to be [illegible] and the younger generation [illegible] physicists seem to have no de- [illegible] or courage to do the job. And the older ones, such as myself? Well, so much of your Foundation's money is going to men who like to play with toys like star- [illegible] ships that there is little left for those of us dedicated to honest, basic science. And in a way it's my fault."

He shrugged and flashed Clark an ironically charitable smile. "But one must be philosophical. You are looking for the foremost authority in matters paratachyonic, Mr. Clark? Then don't come to me; it has gotten out of my hands. Go to the men who play with starships."

Clark squirmed uncomfortably. He understood Rao's reputation better now, but he didn't especially like the way the interview was going. Awkwardly, he said, "You underestimate your position, Dr. Rao. As a matter of fact, ships are what I want to talk about, but I still think you're the man I need to see. The engineers are too close to them. I need someone who can see a bigger picture of the principle and its potential. As its co-discoverer, you seem best qualified. I know you've done some follow-up work. And surely you've followed

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the practical developments at least casually, haven't you?"

"Yes," Rao admitted. "Casually, and occasionally with cynical amusement. As for my own follow-up work, it has borne little fruit because the Foundation neglected to provide fertilizer. But—" he shrugged again, "if you know all that and still wish to ask me questions, I may as well try to answer them, since you have come this far. What are your questions, Mr. Clark?"

"Suppose I told you the government was interested in a large-scale interstellar migration. Much more massive than the little bit of colonization we've tried so far."

"*Are* you telling me that?"

Clark sighed. "*Tentatively*, Dr. Rao, tentatively. It's all quite hypothetical. I'm merely interested in your ideas about feasibility, as a matter of . . . er . . . curiosity. Now suppose we wanted to move as many people as possible. How many people would you estimate that could be?"

Something else had crept into Rao's eyes, but Clark couldn't identify it yet. The physicist just said, "Your question is too broad. How many people per ship? How many ships? How long is this hypothetical operation to take?"

"Well . . . I guess we should think of it as a multivariable-calculus-of-variations problem. Rather than specifying the numbers you mentioned, suppose I just say maximize the number of people while minimizing the preparation time and cost per person."

"Anything else?"

"Assume an all-out industrial commitment to the project. Assume the ships to be capable of supporting the passengers for several months." Rao still stared silently at him and he added, "And if it'll help, you can assume a time limit for completion of the project. Say . . . fifteen years."

Rao nodded as if finally satisfied with something, and began making hen-scratchings on the magic slate panel inlaid in his desktop. "There are still too many variables for me to do more than guesstimate," he muttered as he worked. "Exactly what is an 'all-out industrial effort'? I don't know, but I will guess. Fuel is no problem; subnuclear engines do all the work on both sides of the jump and they'll run on anything. Garbage . . . seawater . . . caviar . . . money . . . Even the mass ratio is not too horrendous. Life-support for several months? It was done on the first trips to Mars and approximated on the recent colony ships; I suppose it can be done again. How many people? It is not my field, but I find it hard to believe more than a few hundred. If you would like a wildly optimistic estimate, let us suppose a ship can carry five thousand. How many ships? Let us say a thousand such ships can be built and launched—surely a wild

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overestimate for fifteen years, is it not? Then that gives you a capacity to move five million people."

Dr. Clark translated mentally. *... that's one thousandth of the population. And his estimates certainly are generous enough.*

"If you would like a more realistic estimate," Rao was saying, "you may ... whichever of the ... fictitious by ... orders of magnitude." He ... and leaned ... in his chair. ... Mr. Clark, if we are ... with images ... said you like to ... be in all this?"

... stood startled Clark. "I ... was hypothetical," he ... slowly.

... smiled benignly. "Come ... not so poor a ... that I cannot see that ... that casual curiosity ... actions. You would ... to visit one ... own views for ... And you would not be so ... in your chair if you ... afraid of showing more ... emotion. If you realize ... advice, does it not seem ... that I should know ... of the problem I am asked to ...?"

Clark wore silently at himself. *Would he never learn to stop being ... transparent at the wrong times?* "... right," he conceded slowly, "there's a little more to it than that." He pushed a button in his pocket. "I'm recording, Dr. Rao. I'll tell you more, with the understanding that it's strictly confidential, and any breach of the confidence is prosecutable by the Foundation and the United Nations."

"Understood. I'm waiting, Mr. Clark."

Hesitating briefly, as if an extra second might bring an inspiration that would make it unnecessary to let yet another person in on it, Clark began his explanation. "We have reason to believe," he said, "that our galaxy has suffered a large-scale core explosion. In a few years Earth will begin a long exposure to dangerous radiation levels. Most of the galaxy has already been affected, and the rest will be. It's been suggested that we might be able to escape to another galaxy nearby by using Rao-Chang ships at unprecedented speeds."

"Please, Mr. Clark, *para-tachyonic*. It embarrasses me to have my name attached to those things. You have 'reason to believe,' you say. What sort of reason?"

Clark debated briefly whether to tell him, then went ahead. "The *Archaeopteryx* crew saw the explosion. You know of the *Archaeopteryx*?" Rao nodded. "They saw it, identified it, ran spectroscopic tests on it, and looked at it from several points between here and the

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point where they made Don Lewiston's observations of S Andromedae, trying to pin down the time when the danger starts."

Rao looked faintly and annoyingly amused. "I see. So you are pretty sure about this thing?"

"Yes."

"Perhaps. Perhaps." Rao looked thoughtful for a couple of seconds, then said, "I assume you see the hopelessness of that suggestion now?"

"Perhaps." Rao seemed not to notice the mimicry. "Knowing that the reason we're interested is a real threat to you and me and everybody else doesn't give you any goad to think a little harder about it? Maybe come up with something you overlooked when you thought it was all a game?"

Rao shrugged. "Facts are facts, Mr. Clark. I gave you my appraisal of them a few minutes ago. The fact that I am personally threatened does not change them. I still find it inconceivable that you could rescue any significant fraction of the population that way." He grinned wryly. "Besides, even if I feel personally threatened, I do not feel any great incentive to be rescued in such a way. Such a voyage would not be pleasant . . . and what would be waiting at the other end?"

"A chance to survive," Clark answered, a bit snappishly. "But nobody has to go. At least some of those who can't or don't want to can stay on Earth and learn to live in underground shelters–"

"Just as bad," Rao interrupted scornfully. He shrugged again; with him, the gesture was so habitual as to have little meaning. "Really, Mr. Clark. Is life itself so precious that I must cling to it at all costs, even if I must live like a rat in a hole? Why bother?"

Clark sat silent for many seconds, breathing heavily and plagued by the knowledge that he was getting nowhere. He was beginning to tire of this. They were *both* beginning to tire of it. Finally he asked in a low voice, "But what about those who *want* to go?"

Rao shrugged. "Let them."

"And you're not willing to help?"

"I see no way I can help. I have no advice to give you." He drummed briefly on the desk and then added casually, "Except that if you're really concerned about this, you might want to send the *Archaeopteryx* out again, out of the galactic plane, to get a better look at the core and make sure that's what your crew was really seeing."

You don't believe this at all, do you? Clark thought incredulously. *You're humoring me.* "The ship's computer already has lots of observations of it," he said–redundantly, he thought. "Including radiation measurements and parallax measurements taken from several observation points along a 130-light-year baseline. We're sure."

"Then," said Rao with a final

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string that carried an air of dismissal. "I can tell you no more." Clark rose from his chair to leave. As he went through the door, he heard Rao add behind him, "Except that you're going to need another expedition anyway to find out just how much time you do have left on you."

Disappointment and frustration churned in Clark's mind as he went outside and called a cab. He was glad the private plane that awaited him at the airport was chauffeured; he was too preoccupied to do his own flying.

He found a shaded bench to sit on while he waited. Over and over he reexamined his conversation with Rao, searching futilely for something helpful buried among the callous indifference and veiled sarcasm. That attitude was real, but he seriously doubted that it had gone so far as to interfere with professional ethics. When Rao gave his opinion that no real rescue plan lay within man's grasp, he believed it. He had not told Clark anything he couldn't have estimated for himself, but he had brought the conviction of authority to it. He had said to rest the haunting fear that Clark, when he reached those same conclusions on his own, was overlooking some saving feature that would be seen at once by an expert.

The expert had spoken.

A small yellow cab pulled up at the curb, almost silently. The driver started to get out and come around to open the passenger door. Clark waved him to stay and opened the door for himself. "Airport," he muttered. He settled back into the seat, arms folded across his chest, as the cab lurched forward.

O.K., he thought, *so what now? I'm supposed to get down on my knees and mouth prayers, maybe?* Somehow the thought rang hollow. He needed to *do* something.

But for the first time in his life, he found himself in a situation where there seemed to be nothing he could do—nothing any man alive could do. A situation where, if help was going to be found at all, it would *have* to come from outside, from a power bigger than all the resources man could muster on his own.

And when the chips were down, Henry Clark found that any belief he had ever had in such a power had evaporated, sometime during the passing decades.

His thoughts merely idled for the last five miles of flat, arrow-straight road. When the cab turned off into the airport, Clark directed the driver to the right gate with the main part of his mind a million miles away. The cab stopped; he gave the driver his Foundation ID and account cards, waited to get them back, and got out with a minimum of thought. He stood absently watching the cab leave, and finally turned and walked slowly

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through the gate in the wire fence, toward the little lemon-yellow swept-wing jet.

Tony, the chauffeur, came out to meet him, traveling with an odd hurried gait that was not quite a run. Tony was young and impressed by his uniform and the importance of his job; he moved with a slightly awkward version of military precision as if on display. "Are you ready to go back, Mr. Clark?" Clark nodded and grunted. Tony hurried to open the door, helped him in, made sure his seat belt was fastened. Just before he stepped forward into the cockpit, he told Clark, "You have a message, sir. Counselor Sanchez wants you to call him back. He said to tell you it's urgent."

Clark felt little reaction. He sat unmoving through take-off, musing idly on what Sanchez considered urgent as the engines roared into readiness and the plane taxied out, thundered down the runway, and rose sharply toward the unbroken blue above. Only when they were well off the ground and climbing less steeply did he punch out Sanchez' call code.

But as soon as Sanchez answered, Clark sensed something unusual in his voice. It was too subtle to put a finger on, but there was some sort of—excitement?—there which in Sanchez was hard to arouse. "Did you find anything out?" he asked.

"No. I . . . just a second." Clark pressed a button; a soundproof glass panel rose to seal him off from the cockpit. He pressed another, and relays isolated this conversation from the pilot's audio circuits. "I saw Rao." He said. "He's as bad as his reputation—though it's not all his fault. He confirmed everything we'd guessed. No way out. Under conditions so favorable they're hard to believe, he can picture a fraction of a percent of the population getting away—if the other ninety-nine-plus give slightly more than their all to make it possible. And I can't picture that. Altruism exists, but this is ridiculous." He paused and added, "So I guess that shoots that. I don't know who else to ask."

"You might think of somebody surprising," Sanchez said. "That's why I called you, actually. We are isolated, aren't we?"

"Definitely."

"Good. I got a really weird call from Kennedy a while ago. They wanted you but settled for me. Seems they noticed a large object in an orbit where nothing belonged yesterday, and sent a shuttle out to investigate. As soon as the shuttle got within fifty thousand miles of it, they got a call on the radio—on the shuttle and at the spaceport and nowhere else that we've heard about."

Clark struggled to sweep the mist away from his mind, concentrating desperately. What was Sanchez getting at?

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"You guessed it," Sanchez said. "The speaker said the shuttle should turn back and stay away from the thing in orbit, and they'd send their own down to Kennedy to talk to us. Created quite a furor at Spaceport HQ, but they decided not to take any chances and called their shuttle back pronto. And now they're expecting company."

"What kind of a prank . . ." Clark muttered, frowning deeply. "Did they find out who it was?"

"Aliens," said Sanchez. "Honest-to-gosh aliens, from Somewhere Else. I know it sounds wild, but it seems to check out, and that's all we know. And they want to talk to you."

"*Me?*" Clark yelped. "You mean *me*, personally?"

"Yep."

"How would they even know I exist? This whole thing—"

"Maybe you should ask them. But they do seem to know."

"But . . . *why?*"

And in his answer, Sanchez' voice conveyed a strange mixture of mysterious fascination and profound doubt. "They said something," he said, "about wanting to help."

VI

Clark was too startled at Sanchez' news to express surprise at the alleged aliens speaking English, but he had plenty of time to think about it as they flew straight to Florida—and then as he and a small hand-picked group waited nervously for the emissaries' arrival.

They watched from the glassed-in room atop a control tower, with a commanding view of the whole spaceport, a network of roads and runways crisscrossing the swampy and scrubby ground all the way to the ocean, studded here and there by spidery towers. Two members of the control tower staff were there, as well as Sanchez and Clark—and Rao, hastily summoned to take a look at the aliens' transportation and listen critically to anything they might say on technical matters. Clark had not been eager to consult Rao again, but a technical consultant was needed, and Rao already knew something of the *Archaeopteryx* affair. The fewer others who found out, the better—and Clark felt a strong hunch that the alien business was not unrelated.

Beyond that, except for a handful of Guardsmen waiting downstairs, there was nobody anywhere within the expansive boundaries of the port. Never before had such extreme security measures been invoked. The fact that they had been today would in itself tend to arouse suspicions among those who had been barred. But Clark had decided that that risk was preferable to letting unscreened hordes witness the arrival of the first extraterrestrial intelligence man had met. Now he only hoped their arrival would not be so flamboyant

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as to draw attention from miles around.

And that seemed a rather forlorn hope.

Long minutes crept by; no sign of visitors materialized. Clark, who had rarely smoked in his entire life, bummed two cigarettes from one of the tower men. The radio was on, but silent. They told him the aliens had spoken on it just minutes before his arrival, but he had not yet heard anything. Finally he muttered impatiently, "I thought you said they would be getting here right away."

"They said they were coming down right away. They didn't say how long it would take."

"Did you ask them?"

The man who had answered before, the older of the two at the central console, nodded. "They didn't answer. They haven't said much to us, actually. They don't seem to hear our questions, and they don't ask any of their own. They just tell us what they're going to do next."

Clark didn't like the sound of that. He asked, "How are they coming in?"

"They didn't say. We offered them the usual landing guidance, but they never acknowledged. Guess they think they can make it on their own."

Clark said no more. Silence grew heavy in the control tower. Then Sanchez said, "What's that?"

Clark turned his head sharply and tried to follow Sanchez' pointing finger. But he saw nothing except a couple of small clouds floating in a sky that was unusually free of them. He started to say so, but just as he opened his mouth he became aware of a deep, almost inaudible hum, and simultaneously thought he saw an elusive glint in the sky—as if one small piece of the blue were trying to detach itself from the rest. But that impression had barely had time to register before he most definitely saw the globe settling onto the pavement less than a hundred feet away from the tower.

He was on his feet instantly, pressing his face against the window. It was a globe, all right—spherical, smooth, and featureless, of a velvety blue that uncannily matched the sky—and hardly more than twenty feet in diameter. It was the source of the hum; on a sudden impulse, Clark opened the window to better gauge its actual loudness. It remained a mere hum, not even remotely resembling the awesome roars of man-made spacecraft. And now it died, its pitch dropping smoothly beyond the limit of human hearing and giving way to an eerie stillness. And the blue globe changed shape, its bottom flattening. Within a minute, the whole thing had relaxed into a dome perhaps thirty feet in diameter at the base.

Nothing else changed. Except that the radio finally spoke behind

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Clark. "Our landing is complete," it said. "We will be in to see you directly." Clark felt an odd excitement. That voice was not human. Its pitch and timbre had elements resembling both alto and tenor, in human terms, and others that fit no familiar labels. Its pronunciation of English vowels and consonants was uncannily accurate, but its overall inflection had a peculiarly singsong quality.

The words penetrated only afterward, when Clark saw an arched opening appear at the base of the dome, with a dimly glimpsed figure moving inside. "*We will be in,*" the voice had said.

Suddenly Clark was tugging at Sanchez' arm and hurrying toward the elevator. "Come on. Let's go down and meet them."

They emerged from the bottom of the tower a few seconds later, just as the aliens emerged from their craft. On the way through the door, Clark snapped instructions to the Guardsmen waiting in two cars. One of the cars, a three-seated sedan with curtained windows, pulled out almost silently to follow him, Sanchez, and Rao as they walked out onto the field.

And the aliens strode toward them—tall, stately, imposing in appearance as their skins and garments glittered in the bright afternoon sunlight. There were three of them, all very similar in appearance, one walking alone in front, the others side by side behind him. Clark thought of the forms they might have taken and marveled at the one they actually wore. He had feared they might evoke involuntary feelings of revulsion, but there was none of that. They were humanoid, with two arms and two legs and walking very erect, their seven-foot forms cloaked in flowing togas full of metallic sheen and wildly colored iridescence. Bare, bronze-hued skin showed only at their feet, hands, and head—a long oval head devoid of hair, with ears and eyes and mouth in familiar positions, but no apparent nose. As they got close, Clark noticed that the one in front somehow looked older. Hard to judge in an alien, perhaps, but old age is a matter of increasing entropy regardless of species, and this one gave that impression—through the slightly olive cast and lesser smoothness of his skin, and in a variety of other ways too subtle for Clark to put his finger on.

What do I say to them? Clark wondered suddenly. Somehow everything he could think of sounded corny. But now they were face to face, standing still at close range, and one of them would have to start a conversation. Looking up into the nearest statuesque visitor's face, he saw that they did have nostrils, but set in the throat, far back under the chin. And he noticed a faint, unfamiliar but not unpleasant smell.

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Finally he contrived a smile and said awkwardly, "Welcome to Earth. My name is Henry Clark. These are Joe Sanchez and Chandragupta Rao."

"Henry Clark," the front alien repeated in the same voice Clark had heard on the radio. "Joe Sanchez. Chandragupta Rao. I am Beldan."

"Beldan," Clark repeated carefully, trying to get the sounds as exactly as he could.

"Beldan," Beldan said again, in a tone so exactly like the one he had used before that Clark concluded that the tone must be an integral part of meaning in Beldan's language.

"Beldan," he said again, this time imitating the pitch of each syllable as well as he could. This time Beldan did not correct him. "I'm very pleased to meet you." He turned and opened the door of the curtained sedan—fortunately one with a high roof and very roomy interior—and told Beldan, "If you'll join us in the car, we'll go to a room where we can talk."

Beldan's slightly bulging eyes momentarily withdrew deep into their sockets, then returned. "Your offer is appreciated," he said, "but the car is not necessary. We can talk here, or we can walk to your building."

"*We* prefer not to stand in the sun," Clark explained. "And the building we will go to is not the closest one. The car is for your own protection."

"Then we will go in it." Beldan turned to his two compatriots and said something in their own language, a terse utterance with an oddly musical (though atonal) pitch pattern, consisting largely of pure vowels but occasionally interrupted by complex consonant clusters. The others' eyes made the same seemingly involuntary movement Beldan's had made, and then they followed him into the second seat of the sedan. Relieved, Clark slid into the third seat, followed by Sanchez and Rao, and the car took off across the field.

"You said the car is for our protection," Beldan said as they started up. "Protection from what?"

The question took Clark by surprise. "Why . . . uh . . . protection from any possible mishap. Not that we expect anything, of course."

Beldan said no more, but Clark caught a glimpse of his face and had the distinct impression that Beldan didn't understand at all.

And that, Clark didn't understand.

The driver whisked them into the administration building through one of the vehicle entrances. They sped through tunnels to the central elevator, and there the three humans and three aliens disembarked and took the elevator to the building's top level. The halls, empty and silent, felt strange. Clark was used to them when people were coming and going and business ma-

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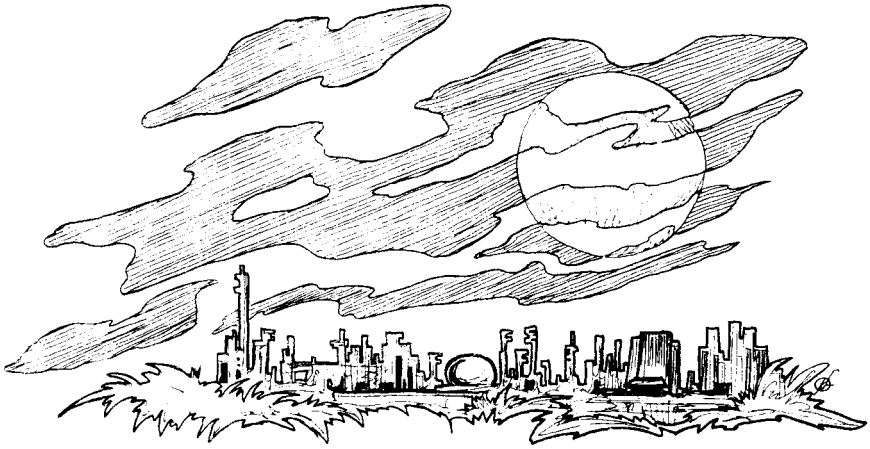

chines were humming and clattering in all the rooms. Today's security was so complete that all operations had been suspended even here. Arrangements had been made hastily to route all telephone business to outside stations, but Clark was painfully aware that all that was purely stopgap.

A conference room awaited them at the end of a corridor. It was similar to the one in which Jonel Turabian had first announced that the galaxy was exploding, but considerably larger. They filed in and took seats around the oval table; as if following unspoken directions, the humans sat along one long side and the aliens along the other. During the awkward pause as they settled into chairs under bright, even fluorescent lighting, Clark noticed details about the visitors that he had missed before. Things like the uniform bright red of their eyes, the long slender fingers and the presence of two thumbs on each hand. And details of their clothing—the intricate rippling color patterns had struck him immediately outside, and now he was increasingly impressed by the abundant use of metals in them, both in numerous small ornaments and in the fabrics themselves. The effect was breathtakingly beautiful—and, by human standards, incredibly extravagant.

When everybody seemed to be settled, Clark self-consciously smiled his best official smile and said, "Under ordinary circumstances, I'd begin a meeting like this by offering our visitors refreshments. But I'm afraid I haven't had many guests from off Earth before, and I wouldn't know what to offer you. So if there's anything I can get you, please don't hesitate to ask for it." He paused, cleared his throat, and changed the subject. "After that, I hardly know where to begin. Perhaps I should compliment you first on your excellent

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command of English. May I ask how you came to acquire it?"

Beldan's lips parted, revealing a single highly polished ridge across the front of each jaw, where a man would have incisors and canine teeth. Another such ridge extended back each side of each jaw in place of molars. The gesture seemed intended as a smile, but Clark sensed that it was not a native one; instead, Beldan seemed to be consciously imitating the human response. "We have been orbiting your planet for several days, monitoring your public communications with modulated electromagnetic waves." (*Radio and television,* Clark translated.) "There is a wealth of study material there from which to learn the language."

"You learned very well . . . and fast." Clark found the answer incomplete and unsatisfying, but he decided not to pursue it headlong. Instead he asked, "What has brought you to Earth?"

"We noticed your ship in super-c—the *Archaeopteryx,* I believe you call it. From its behavior, repeatedly making the transition between sub-light and faster-than-light travel, we concluded that its crew must have observed the galactic core explosion and was trying to learn more about it. We followed it home, believing that perhaps you would need help in order to escape the tragedy. We may be able to offer such help."

Clark's heart jumped wildly. Only hours before, he had been driven to the desperate realization that outside help was the only thing that could provide a way out. Then it had seemed impossible. Now he was sitting across a conference table from a sophisticated extraterrestrial being who was on the verge of making an offer.

It seemed too good to be true. So much so, he cautioned himself roughly, that he'd better guard against investing any optimism in it until it had been so thoroughly checked out that skepticism was no longer possible. He said only, "Your people are already fleeing the core explosion?"

Beldan nodded. Again, Clark didn't know whether the gesture was native or acquired, but it fit. "We—we call ourselves Kyyra—we lived much nearer the core. Not actually inside the galactic nucleus, by your reckoning, but close by. Our homes were among the first and most direly threatened, so we had no alternative but to flee outward. And since no place in this galaxy could be counted on to be really safe, we plan ultimately to relocate in the nearest other galaxy of similar type—the one you call M31."

Before Clark could answer, Rao said. "Perhaps you could tell us as a point of information, Beldan—" he made no attempt at correct intonation, "just how long we have until the radiation from the core begins reaching us."

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"You have." Beldan answered without hesitation, "just under seventeen of your years. At that time, levels will rise sharply and dangerously. They will continue to rise for many years thereafter."

"I see." Rao showed no emotion. Clark had the feeling he was testing Beldan, but could not see just what he was driving at. "You say you are from near the core. Did any members of the party you are traveling with actually see the explosion begin?"

"No," said Beldan, "but my father did." He seemed uncomfortable, as if the question had awakened unpleasant memories. He reached into a concealed pocket in his robe—Clark noticed as he did so that his arm moved as if it had two elbow joints instead of one—and pulled out a small tube of intricately shaped black metal. Clark's first reaction was to fear that some unintentional offense had been given and the tube was a weapon. Then Beldan took its end in his mouth and Clark was reminded of himself lighting up a cigarette in a moment of unusual anxiety. But Beldan didn't smoke it—he played it. It had holes and buttons arranged for Kyyra fingers, and he blew it and manipulated the holes to produce a brief but haunting fragment of melody, in a sweet tone pitched at least an octave below what should have been coming out of such a small tube.

He broke off in mid-phrase, with a hint of what might have been amusement. "You seem surprised. You must learn to take no notice of this; most Kyyra carry a music-pipe and may use it at any time." He played a few more notes, then stopped and looked back at Rao. "You were saying, Mr. Rao?"

Rao stared at the music-pipe with unabashed curiosity for a few seconds, then looked Beldan in the face. "I am a little puzzled by your offer of help. Can you tell me if your mode of faster-than-light travel is the same one you saw the *Archaeopteryx* using?"

"There are differences in detail," said Beldan, "but the principle is essentially the same."

"Then I remain puzzled. We have thought about the problem and could see no conceivable way, in the time available, to build and launch enough starships to carry any sizable fraction of our population."

"Nor would we try to do it with ships."

"Then what would you use?"

"Your planet," said Beldan. "The Earth."

Out of the corner of his eye, Clark saw Sanchez looking much more startled than he normally allowed himself to look. Rao just kept staring skeptically at Beldan, waiting for clarification. After a momentary pause, Beldan went on, "Surely you do not imagine that we would attempt to move a population in tiny individual vehicles

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such as the one in which we came to this meeting. That would indeed be hopeless, Mr. Rao. But please remember that we Kyyra have been a technological civilization far longer than you. We have learned a few things you have not had time to begin exploring yet. The vehicle in which we came is a mere landing shuttle sent from the much larger starship which your observers saw parked in orbit around your planet. And that starship is but one member of the convoy accompanying one of the home planets of the Kyyra. The planet itself was converted in its entirety to a ship to carry the billions of passengers who were born there."

Clark trembled with excitement—and fear. If Beldan was telling the truth, the abilities of the Kyyra just might be awesome enough to do what mankind needed. But would it carry a price equally awesome?

That was one of a whole chain of questions burning in his mind, questions which he or somebody would eventually have to ask the Kyyra. But right now it would be prudent to wait.

He heard Sanchez ask, "What do you use for fuel when you convert a planet to a starship?"

"The planet itself provides the fuel," said Beldan. He again put the music-pipe to his lips and played a tune made of high, long notes, simultaneously shrill and plaintive.

Clark fought down the last temptation to ask his questions now, and decided to intervene before somebody else did. "We are grateful for your offer," he told Beldan, rather stiffly. "You'll understand that we will need to have more details, and time to consider . . ."

"Of course," said Beldan, and went back to his piping.

"We need time to consider even what you've said so far. Would you object to ending this discussion now and resuming it tomorrow?"

"Not at all," said Beldan. "You will take us back to our shuttle in the car?"

"We were hoping," Clark said, recognizing even before he started that the point could be awkward, "that you would accept our hospitality and stay in special quarters we've prepared for you here, as our guests. If it's not inconvenient."

"It is a matter of indifference to us where we stay," Beldan assured him. "We don't wish to put you to any trouble, but if you prefer that we stay in your quarters, we will be pleased. If you will only take us back to our shuttle long enough to get a few things . . ."

"Of course." That had been easier than he had feared it might; he allowed himself the luxury of feeling relieved. Only later, when the Kyyra trio was securely quartered for the night and the other humans were out of questioning range, did he allow himself to really consider what he faced in the upcoming rounds of questions and decisions.

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And he whistled softly at the enormity of it. *Wow*, he thought. *You rest for the wicked, they say . . .*

VII

Clark spent enough time at Kennedy Spaceport to rate his own apartment there. He retired to it as soon as the Kyyra were secure in theirs, and late that evening he sat on the edge of the bed in his bathrobe, staring at the telephone. A shower had helped to clear his mind, but as he sat there pondering whether or not to make the call, he felt the loss of Dianne more acutely than ever before. He had hardly realized at the time how much she had helped him through rough spots in the years of university jobs, industrial jobs, and finally this one that he had held for the last ten years. She had helped simply by being there to talk to, even about things that he found difficult to discuss with anyone else. The mere act of talking about them had often seemed to dissolve the difficulties surrounding tricky decisions. Now, more than ever, he needed somebody to talk to.

Only Dianne wasn't here now.

The most immediate problem he faced was to tell Gerber about all this, or to put it off. Franz Gerber was the head of the United Nations and therefore technically not even in the same chain of command as Clark: the World Science Foundation was officially an entirely separate organization. But in practice the two agencies cooperated so closely in such matters as international space programs and ecological decisions that sooner or later Gerber would have to be brought into this. It was more essential to notify him, in fact, than to notify Clark's nominal superior. The WSF Commissioner of Grants had evolved into such a sinecure that in fact Clark himself now held the highest responsibility in that area.

Calling Gerber would be, to put it bluntly, a way to get rid of that responsibility. A part of Clark longed to do that. He had never felt comfortable about making decisions that deeply touched the lives of many people. As Lieutenant Commissioner he had to grant or deny research funds, but that had never seemed to be at all the same sort of thing as this. This went so far beyond that that the sooner it was turned over to the UN, the better.

Almost convinced, he reached out for the phone—and then drew his hand back, hesitating again. *On the other hand,* he suddenly found himself thinking, *the stakes are so high that I'd hate to let* anybody *else in on it before I'm sure it's the right thing to do. Even Gerber.*

Gerber would be angry, of course, if he found out that Clark had been holding out on him. That was even a real possibility. Yet somehow, at the moment, it seemed much less important to

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Clark than he might have thought it would.

"Nobody has *to go,"* he had told Rao, back in his office—just this morning, he realized with sudden amazement. It had been an incredibly long day. *"Nobody has to go."* That had been true, for the kind of scheme they had been discussing then. Beldan's proposal introduced a whole new element. Under it, everybody had to go—or nobody. Every man, woman, and child in every country on Earth; every fish, whale, caterpillar, and alligator. Everybody and everything on Earth was directly and irrevocably affected, and everybody and everything on Earth had to go along with the same decision. There was no individual option.

And that, he thought glumly, *is simply and literally a kind of decision that nobody before me has ever had to make. How I'd love to pass the buck—and how afraid I am to do it!*

He continued to stare at the telephone, but his hand lay limp in his lap. An ironic thought crossed his mind and he laughed. "Alas, poor Hamlet!" he said aloud.

There was a knock at the door.

Clark looked up, startled. "Who is it?"

"Rao," said a muffled voice. "May I come in?"

Clark hesitated very briefly, frankly irritated. Then he said, "O.K. Just a minute." He got up, drew the robe tighter around him, and went to unbolt the door. Rao thanked him with exaggerated graciousness and came in, still in the same turtleneck suit he had been wearing in his office so long ago this morning. Each of them took one of the two armchairs; Clark settled back and waited wearily for Rao to state his business.

"Since you brought me here as a scientific consultant," said Rao, crossing his legs and staring straight at Clark, "I feel justified in raising a couple of questions about this Beldan character and his offer. Perhaps you've already thought of them, but I'd rather not take chances. So please indulge me, Mr. Clark. First, I trust that in considering any offer, you will give due thought to the question: can we trust them?"

"I'll certainly try to," Clark said coolly. "Do you have something specific in mind?"

"Not too specific, Mr. Clark, not too specific. I merely want to make sure you are fully conscious that, although we do not yet know the details of their offer, they are certainly going to involve drastic changes in the Earth. Leaving the sun . . . using up large portions of the Earth as fuel . . . manipulating energies so vast that we can hardly imagine them, much less control them. If they can actually manipulate energies of that scale, they could do tremendous damage as easily as useful work. And since the methods are beyond our own capa-

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[illegible] would be at their [illegible]. We would have only their word that they will actually use [illegible] the way they have [illegible] so I must ask: can we [illegible]?"

"I've thought of all that," Clark [illegible]. "In case you've [illegible] I'm not just a politician. [illegible], some four years as a ser[illegible]."

"I know, Mr. Clark," said Rao, "and I agree that was a shade too [illegible] to be offended." He [illegible] and then said, "Secondly, I was struck by the fact that neither [illegible] Counselor Sanchez inquired about their motives for the offer. Even for a race accustomed to dealing with enormous energies, surely converting an entire planet to a superior intergalactic transport is not a casual undertaking."

Clark nodded vigorously. "I know. I assure you that question was very much in my mind. *What's in it for them?* But I do believe my *diplomatic* judgment is better developed than yours, Dr. Rao. We don't know enough yet to gauge what their response to such a blunt question would be. Quite conceivably they would take offense—possibly even to the extent of withdrawing the offer. I most definitely wanted to avoid risking that. They may be our only chance, and their motives may be straightforward and legitimate. I certainly intend to ask them, in good time. But today wasn't a good time."

Rao, characteristically, shrugged. "Well, you had *better* ask," he said. "And not merely out of idle curiosity. I smell a rat."

Clark looked at him sharply. "Why?"

"Do you recall Beldan's response when I asked whether any of their party had actually witnessed the beginning of the core explosion?"

Clark thought, then remembered. "He said no, but his father did."

"Exactly. Now admittedly, there may be some ambiguity in what is meant by 'witnessing the beginning of the explosion'. In a sense, we will do it ourselves in seventeen years. But I surmise that in the case of the Kyyra, it means more than that. Since we are also told that the home planets of the Kyyra were near the core, I think it is reasonable to assume that Beldan's statement implies that his father was *nearby* when the explosion began. In other words, that Beldan's father witnessed the beginning of the explosion from somewhere among their home planets, which are near the core."

Clark frowned. "So?"

"Mr. Clark," Rao asked, "how long do you suppose the Kyyra live?"

Clark did not relax his frown. He didn't see yet what Rao was leading up to, but he did sense that he was leading somewhere. "I can hardly say. Our total contact with them has been a matter of minutes—or hours, perhaps—"

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"Granted. But let us deal broadly, with orders of magnitude. Does it not seem that, in view of their similarities to us and what we know about lifespans of terrestrial animals, their lifespan is far more likely to be measured in decades, or centuries, than in longer units?"

"I suppose so. But—"

"Then consider this. Beldan's statement implies that their migration has been on its way for not more than two generations. Let us suppose that means a hundred years, measured in the frame of reference of their motorized planets. There are two possible ways to achieve that at super-c velocities, as you may recall. How familiar are you with the time and energy considerations in operation of the paratachyonic drive, Mr. Clark?"

"Casually. If it's crucial to your argument, maybe you'd better jog my memory."

"It's crucial. You will recall at once the Einsteinian time dilation effect that becomes pronounced as you approach the speed of light from below. Conveniently understood in terms of space-time diagrams—except that it now turns out, thanks to me and Chang, that space-time diagrams don't mean what we used to think they did. We don't really know what they mean any more. No matter; we know empirically what the time situation is in super-c. You get the same time dilation effect at *n* times the speed of light as you do at one-*n*th of the speed of light. So if you run a ship either far below c or far above it, you get little time dilation and shipboard time is nearly the same as galactic time. If you run close to c, either above or below it, you get a large time dilation effect and the closer to c you are, the *shorter* shipboard time is compared to galactic time.

"We have established that ship's time for the Kyyra migration to this point has probably only been on the order of a century, and we know they're running faster than light and they've had thirty thousand light-years to come. They could have achieved this *either* by running much faster than light, in which case galactic time for the trip would also be close to a century, *or* by running *very slightly* above the speed of light, in which case —"

"—galactic time would be close to thirty thousand years!" Clark finished in unison with him, suddenly seeing at least part of what he was driving at. "But we know that the galactic time *was* close to thirty thousand years, because Beldan's father was at home when the explosion happened. If they'd been using the higher speed, they wouldn't have even started until a hundred years ago."

"In which case," Rao nodded, "the beginning of the explosion would have been thousands of years before Beldan's father's time—and very likely would have wiped out the species before they

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even had time to think about launching a trip at this late date. In fact, for just that reason, they must have set out not long after the explosion. Just how long depends on how close it was, but from Beldan's description, there must not have been very much safety margin. Yes, Mr. Clark, they have been operating their planets and the ships [illegible] them at an observable slow velocity—probably not [illegible] thousandth of a percent [illegible] than the speed of light. [illegible] very strange."

[illegible] why. "Because [illegible] considerations."

Rao nodded triumphantly. "Yes. [illegible] time dilation is the same [illegible] reciprocally matched speeds above and below c, so is the kinetic energy—and that means fuel requirements—to achieve that speed. A speed [illegible] requires the same energy as one-half of the discontinuous transition between those two speeds involves no net energy [illegible]. A speed of one hundred c in principle requires as little energy as [illegible] hundredth c. We only bother to accelerate farther than that because the transition is far easier to manage at a speed where the barrier is narrow. But we've never even considered accelerating farther than about two-thirds c before jumping into superc. With complete mass conversion and an all-photon exhaust, a one-way trip like that needs a mass ratio well under ten. But the 100000k the Kyyra seem to have been using takes the same energy as five nines c and with the same assumptions, that's a mass ratio of about a hundred thousand."

Clark saw it all now, and his mind was wide awake and racing. Rao's point was not merely valid—it was staggering. "In other words," he said softly, getting up and pacing the floor, "no matter how they did it, they've gone to a tremendous amount of trouble and expense to go very slowly—when it would have been not only easier and cheaper, but you'd think more desirable, to go faster. Why? They must have had some pretty compelling reason to do that . . ."

And in that instant he knew he wouldn't sleep much that night.

TO BE CONTINUED

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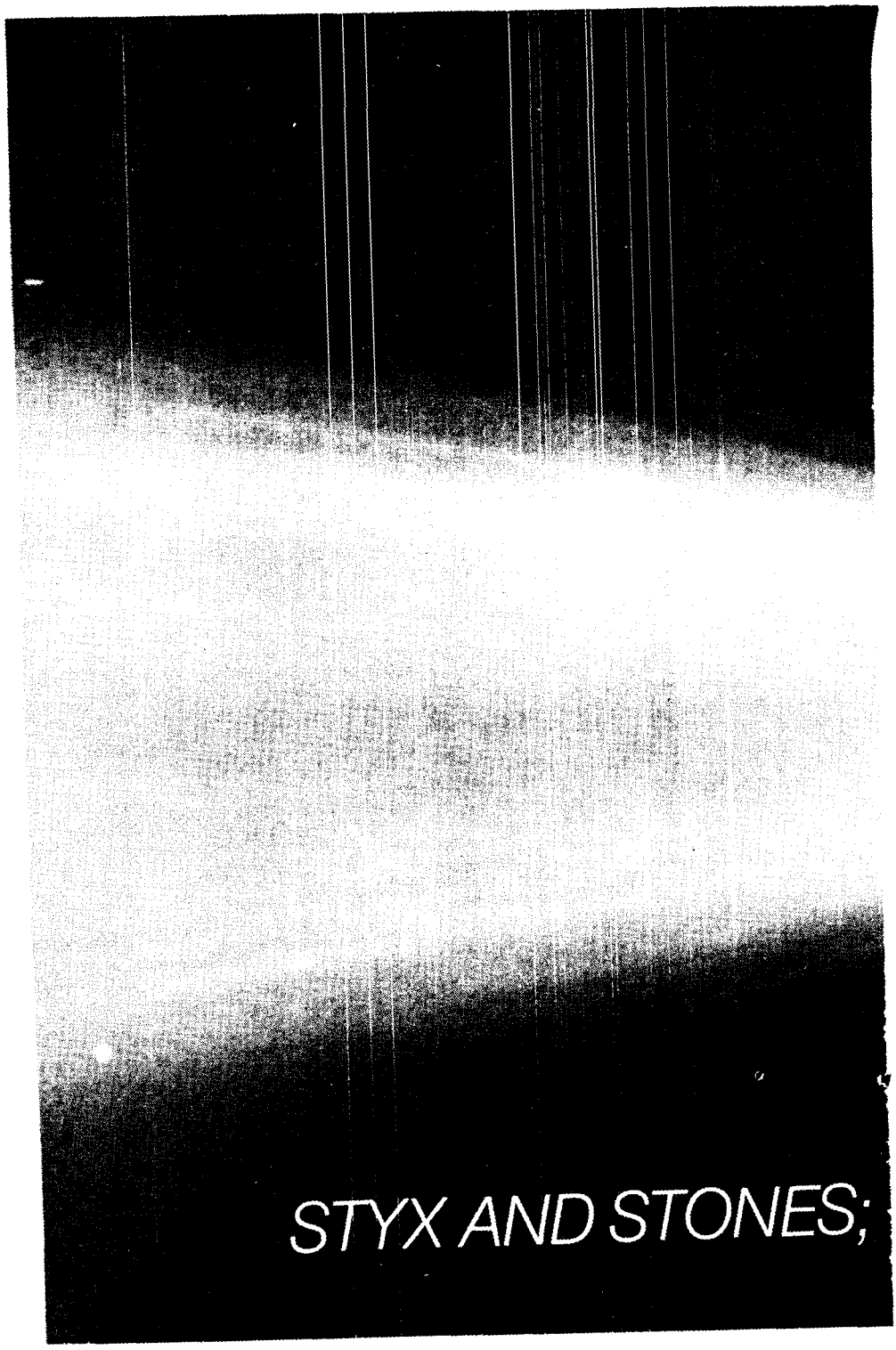

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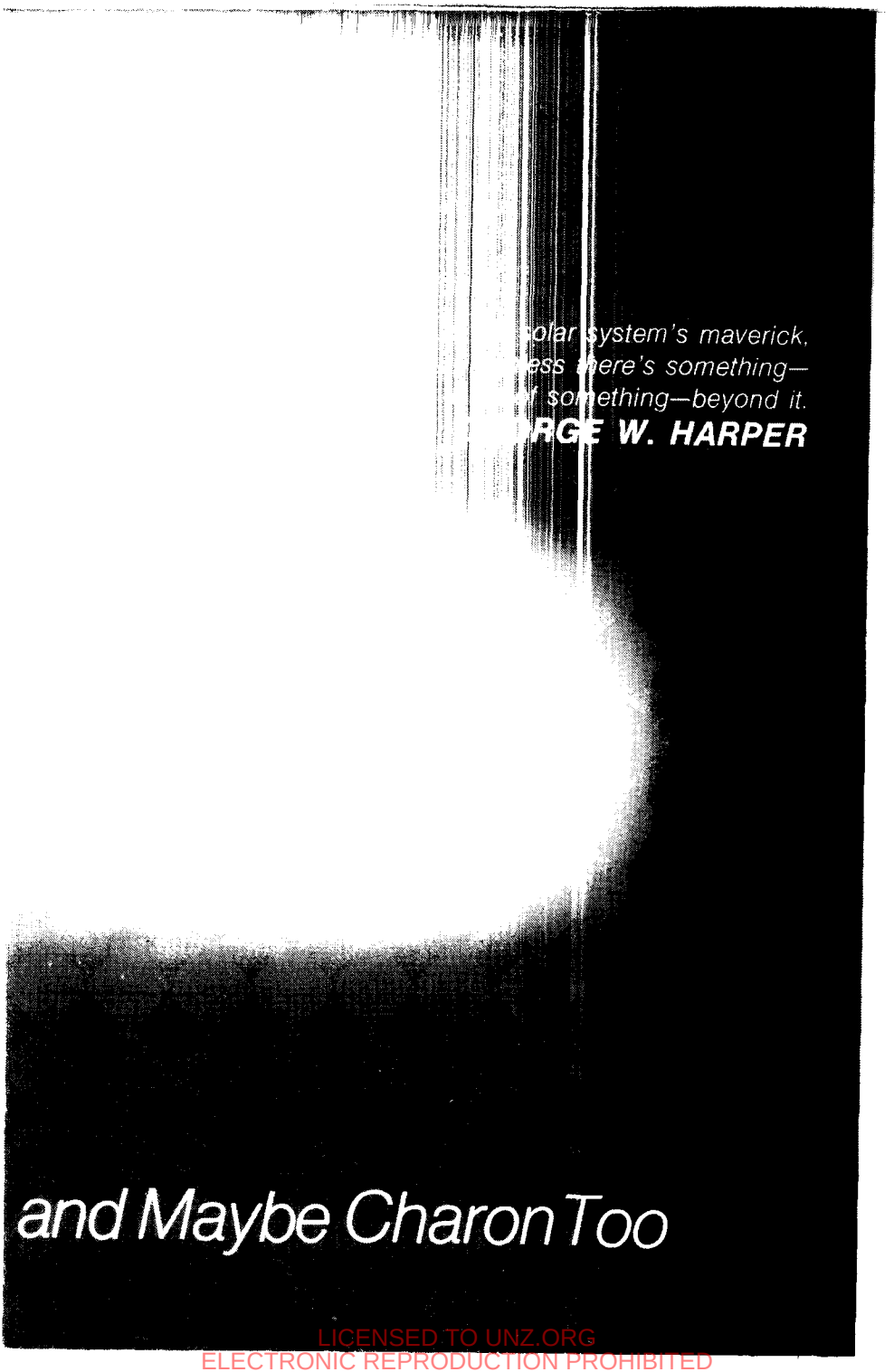

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In 1766 the German mathematician, Johann Titius, wrote a brief footnote to a book on natural philosophy he was translating from the French. The book itself is long forgotten save for a few scholars, but the footnote has led a lively career. As translated by Stanley L. Jaki of Seton Hall University, it reads: "Divide the distance from the sun to Saturn into 100 parts; then Mercury is separated into 4 such parts from the sun; Venus by 4 + 3 = 7 such parts; the Earth by 4 + 6 = 10; Mars by 4 + 12 = 16. But notice that from Mars to Jupiter there comes a deviation from this exact progression. After Mars there follows a distance of 4 + 24 = 28 parts, but so far no planet or satellite has been found there . . . Let us assume that this space without a doubt belongs to the still undiscovered satellites of Mars . . . Next to this for us still unexplored space there rises Jupiter's sphere of influence at 4 + 48 = 52 parts; and that of Saturn at 4 + 96 = 100."

Nor was this the first prediction of a planet between Mars and Jupiter. Nearly two centuries earlier, around 1595, Johannes Kepler penned the unambiguous sentence: *Inter Jovem et Martem planetum interposui,* or "Between Jupiter and Mars I interpose a planet."

Either way, the mathematical relationship expressed by Titius and the prediction by Kepler remained curiosities until the summer of 1781, when William Herschel proclaimed a new planet in the firmament, a planet which he named "Georgium Sidus" in honor of mad King George III, of Revolutionary War fame. With this discovery it was quickly realized the new planet fitted neatly into the next interval of the Titius Rule, at 4 + 192 = 196.

Herschel's discovery refocused attention on the Titius Rule and incidentally, on a rather nasty but unfortunately somewhat typical situation which had arisen during the previous 15 years. The preeminent German astronomer of the time, one Johann Bode, had simply appropriated the Titius Rule and claimed it for his own despite the fact he had earlier explicitly acknowledged Titius' priority. As he had the wholehearted cooperation of the German astronomical fraternity the expropriation stuck and it is today generally known as the "Bode" Rule.

Ordinarily we wouldn't mention Bode here save for an unexpected irony. Bode was the astronomer who renamed Georgium Sidus, calling it Uranus. So, oddly enough, he got credit for the rule he stole and never received proper recognition for the planet he named! Maybe things come out even after all!

Still, the rule remained mostly a curiosity until New Year's eve, 1800-1801, when the astronomer-monk Gieuseppe Piazzi discovered what he first believed to be a pecu-

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liar comet with an unusually circular orbit in a position roughly between Mars and Jupiter. But then Karl Friedrich Gauss proved it to be a small planet, orbiting at a distance of 27.7. The planetoid was later named Ceres and has since been proven to be the largest of the asteroids.

Once the asteroids were fitted into the 28 slot, the Titius Rule stood triumphantly confirmed. As of 1801 the solar system had a neat, complete look about it. Everything was in its place and all was right in the heavens. The *reason* for the rule might be obscure, but the *validity* was unquestioned.

Shortly after the discovery of Uranus astronomers began to realize that the existence of the planet could have been predicted far in advance of its discovery. The period of Uranus is 84 years. The period of Saturn is only 29½ years. This means that roughly every 40 years Saturn and Uranus come into conjunction. When Saturn starts to overtake Uranus it is accelerated by the gravitational attraction of the other planet. When it passes out of conjunction and begins receding, the attraction of Uranus pulls on Saturn and slows it down.

The actual effect of this is the reverse of what we should expect. The acceleration of Saturn caused by Uranus translates itself into a higher orbit and a consequent retardation of speed in its motion about the sun. As it passes Uranus, the gravitational drag is converted into a lower orbit and an increase in speed. The fits and starts of Saturn had been observed for years without anyone ever suspecting the reason, but once the phenomenon was recognized, mathematicians commenced analyzing the motions of Uranus and Saturn to look for evidence of additional residuals which might indicate the presence of other planets.

They found them.

Adams in England and Leverrier in France arrived independently at the same conclusions. Adams was a bit ahead of his rival, but he made the mistake of turning his calculations over to the Astronomer Royal of England. And that worthy had better things to do with his time than worry about the calculations of some amateur. Leverrier had better luck, and on September 23, 1846, Neptune was discovered.

Then a ripple of dismay began spreading through the ranks of astronomers. Rather than falling at 388 as the Titius Rule suggested, Neptune orbited at a scant 300, or over 800 million miles from where it belonged!

When Pluto was discovered, some 84 years later, the difficulty was compounded. Rather than orbiting at 772, as the Titius Rule predicts, it loops out in a highly eccentric orbit ranging from 290 to 420, and averaging 394. (See Table I.)

In other words, after Uranus the

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planet	Titius interval	true value
Mercury	0.4	0.39
Venus	0.7	0.72
Earth	1.0	1.00
Mars	1.6	1.52
Asteroids (Ceres)	2.8	2.77
Jupiter	5.2	5.20
Saturn	10.0	9.54
Uranus	19.6	19.18
Neptune	38.8	30.06
Pluto	77.2	39.44

TABLE I. (Titius Rule)

whole system goes to pot! One result of this has been an effort by some astronomers to call the whole rule a fluke. "Pure coincidence," they scoff . . . but even in their scoffing we sense a certain uneasiness; as if there is a lurking fear there is unfathomed significance to the old rule after all.

The fear seems justified when we turn to look at the satellite systems circling some of the outer planets. Take Uranus, for instance. Here we find five beautiful satellites, all in perfect equatorial orbit about the planet, and all with very nearly zero eccentricities. If we apply the Titius Rule here, we find an excellent approximation save for a moderately considerable discrepancy with the innermost satellite, Miranda, and a massive discordancy with the outermost, Oberon. (See Table II.)

When we consider the five inner, regular satellites of Jupiter, also listed in Table II, we again arrive at an interesting approximation of the rule. Barnard's Satellite and Io are definitely too close to their primary, but Ganymede and Callisto are squarely on the mark. The more distant satellites, being highly

planet & satellite	Titius interval	true value	actual distance (in Km)
Uranus			
5. Miranda	0.4	0.487	130,100
1. Ariel	0.7	0.720	191,800
2. Umbriel	1.0	1.000	267,300
3. Titania	1.6	1.640	438,700
4. Oberon	2.8	2.195	586,600
Jupiter			
5. Barnard's Satellite	0.4	0.27	181,000
1. Io	0.7	0.63	421,800
2. Europa	1.0	1.00	671,400
3. Ganymede	1.6	1.60	1,071,000
4. Callisto	2.8	2.81	1,884,000

TABLE II. (Satellite systems)

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planet		Titius formula	true value
Mercury		4 + 0 = 0.4	0.39
Venus		4 + 3 = 0.7	0.72
Earth		4 + 6 = 1.0	1.00
Mars		4 + 12 = 1.6	1.52
Asteroids (Ceres)		4 + 24 = 2.8	2.77
Jupiter		4 + 48 = 5.2	5.20
Saturn		4 + 96 = 10.0	9.54
Uranus		4 + 192 = 19.6	19.18
Neptune	(Standard)	4 + 384 = 38.8	
	(Modified)	4 + 288 = 29.2	30.06
Pluto	(Standard)	4 + 768 = 77.2	
	(Modified)	4 + 384 = 38.8	39.44
X	(Modified)	4 + 576 = 58.0	?
X + 1	(Modified)	4 + 768 = 77.2	?

Uranus satellites		Titius formula	true value
5. Miranda		4 + 0 = 0.4	0.487
1. Ariel		4 + 3 = 0.7	0.720
2. Umbriel		4 + 6 = 1.0	1.000
3. Titania		4 + 12 = 1.6	1.640
4. Oberon	(Standard)	4 + 24 = 2.8	
	(Modified)	4 + 18 = 2.2	2.195

TABLE III. (Modified Titius Rule)

eccentric and inclined in orbit, are considered to be later acquisitions and thus not subject to the rule.

A substantial improvement in the accuracy of the Titius Rule is achieved if we postulate that whenever a given condition is fulfilled at the outer edges of the system, the planets or satellites out there will tend to condense at half intervals. The precise nature of this condition is unimportant at the moment, but as a guess we may hazard it is somehow related to the density of matter per unit volume of space. But even if the reason is obscure, the fact of the improvement is real. Neptune and Pluto fall neatly into place in the solar system, and Oberon fits just as neatly into the pattern of Uranus' satellites. (See Table III.)

It may be objected that the failure of the Saturn satellites to conform invalidates the hypothesis, but we may counter by observing that the Saturn family is exceptional in more ways than just this one. For instance, how do we account for the fact Mimas and Enceladus have abnormally low densities, being only 0.5 and 0.7 that of water respectively? Tethys, the fourth satellite out, has a density of 1.2, and

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planet or satellite	distance	radius (km)	density	inclination	eccentricity
Saturn		60,400	0.687		
Janus	159,200	240	0.4	0.0 ?	0.004 ?
Mimas	185,700	250	0.5	1.5	0.0196
Enceladus	238,200	320	0.7	0.0	0.0045
Tethys	294,800	510	1.2	1.1	0.0000
Dione	377,700	450	2.8	0.0	0.0021
Rhea	527,500	650	2.3	0.3	0.0009
Titan	1,203,000	2401	2.42	0.3	0.0289
Hyperion	1,484,000	200	1.58	0.6	0.110
Iapetus	3,563,000	600	2.21	14.7	0.290
Phoebe	12,950,000	150	?	210.0	0.166

Saturn's Rings

Outer Radius from Saturn's center = 138,000 km.
Outer A Ring: (Bright) = 120,000 km.
Cassini Division (Dark) = 116,000 km.
Main B Ring: (Very Bright) = 90,000 km.
Inner (Kirkwood) Gap: (Dark) = 89,000 km.
Crepe Ring: (Very Faint) = 71,000 km.
Surface of Saturn: = 60,400 km.
Thickness of Rings = 15 km.
Mass of Rings = 0.00004 the mass of Saturn, or 1/2,375,000 the mass of Earth

TABLE IV. (Saturn's family)

we can show that the small size of the Kirkwood gaps in Saturn's rings precludes a density greater than 0.4 for Janus, the newly discovered innermost satellite of Saturn. In fact, not until the fifth satellite, Dione, do we begin to develop 'normal' satellite densities. (See Table IV.)

Conventionally, astronomers draw a distinction between "terrestrial" and "jovian" planets and satellites, calling Saturn's inner family "jovian." It seems likely this is an artificial distinction, especially since Jupiter has no "jovian" satellites and we find no evidence of a pattern in the placement of these satellites around other planets. It seems more probable the same factors which contributed to the formation of the ring system also messed up the Titius Rule and created a whole set of underdense satellites with anomalous orbits.

Admittedly, the argument is not overwhelmingly convincing, but with so many peculiarities in and around Saturn, we need not be surprised when the Titius Rule also goes by the wayside. It is simply one more oddity in the system.

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So in summary, it looks as if the Titius Rule contains elements of reality and represents something more than simple coincidence. Granting this much, if a tenth planet should exist in our solar system we would expect to find it wandering in orbit at around 58 astronomical units. An eleventh planet would probably fall somewhere around 77.2 a.u. Further, as the formula for naming planets is already fairly well established, we can go ahead and name a tenth planet "Styx" and an eleventh "Charon" without doing violence to tradition.

That is fine as far as it goes, but there is a fly in the ointment . . . Pluto. Considering the true value for Neptune and the half intervals of the modified Titius Rule, Pluto is exactly where it belongs. But this is almost the *only* thing right about the planet. Everything else is wrong. Its orbit is too eccentric, its mass is too small, its composition and density evidently wrong, and its rotational period faulty. In fact, astronomers would probably much prefer that Pluto were not there. But unfortunately, it is there, and we have no convenient way of ignoring the planet. So we must try to explain it.

The matter begins in 1915, when Percival Lowell published an extensive theoretical mathematical analysis of observed deviations in the orbits of Uranus. From these he deduced the existence of a planet beyond Neptune and arrived at a probable location.

But this was not the first effort to seek out a transneptunian planet. As early as 1834, Hansen indicated a belief that a single planet would not account for the residuals in the orbit of Uranus. In 1880, Todd made a systematic search using the 26-inch refractor at the U.S. Naval Observatory. There were others too, but these were probably first in their respective areas. Hansen first suggested the planet, Todd first sought for it, and Lowell first arrived at a mathematical prediction.

When Pluto was finally discovered, in March of 1930, it turned out to be within six degrees of Lowell's predicted position. This is phenomenally good mathematics, and the likelihood of coincidence is negligible. But even as the discovery was being announced, astronomers at the Lowell Observatory were hedging their comments. If Lowell's mathematics were correct, Pluto had to have a mass 6.6 times that of Earth; that is, assuming the distance at which it was actually found. This led to problems, for the planet appeared to be about the size of Mars, or roughly .25 the volume of Earth. This would imply a density of 147.0 for Pluto as contrasted to Earth's density of 5.52, which would make Pluto consist mainly of collapsed matter!

Unfortunately, this creates its own problems. It happens Pluto's orbit is the most eccentric of any

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planet in the system. At its point of nearest approach to the sun, on May 5, 1989, it will actually be located *within* Neptune's orbit! As Pluto is highly inclined, there is no danger of collision with Neptune, but it is a lead-pipe cinch any planet with 6.6 Earth masses coming that close to Neptune would perturb it mightily over the ages, both in terms of orbital ellipticity and inclination. And what do we find? We find Neptune to be second *least* perturbed of any planet in the solar system, with an eccentricity of 0.0087. Venus is slightly better, with an *e* of 0.0068, while Earth is just behind, with an *e* of 0.0167, roughly twice as great. Uranus is a distant fourth, with an *e* six times larger than Neptune's. This datum alone causes all other arguments to pale to insignificance. There is simply no way Pluto can wind up with a highly considerable mass. The assumption of .10 Earth mass for Pluto seems about right, and it is difficult to concede any more.

If we accept all this, it means Lowell's mathematics were accidental. The mass of Pluto turns out to be so inconsiderable there is no way it could give results of the magnitude postulated. Taken at face value, the whole discovery becomes a fluke . . . or so goes the argument today.

Taken by itself, the matter could easily be dismissed. After all, Pluto is still in the right place so far as the Titius Rule is concerned. If more planets are to be found we should expect to find them at 58.0 and 77.2 a.u., so it really makes little difference if Pluto turns out to be smaller than we anticipated. This would appear to be a clear and concise conclusion.

But there is a problem. In Pluto we have a tiny planet with an orbit intersecting that of a major planet. The question inevitably arises, how stable can such orbit be? Is there perhaps a point in time where the two would have to bump?

Computer simulations fail to reveal such a point, but as they can only be projected a few millions of years into the past and future, this is inconclusive. Much can happen in four billion years which wouldn't even be hinted at in the course of a few million. Thus, there is a distinct possibility of collision, either in the past or the future.

A collision in the future is simply an interesting possibility. Almost certainly the last, enfeebled descendants of humanity will have long since perished ere this time comes. And there is no conceivable connection with our problem at the moment. Whether or not Pluto collides with Neptune is irrelevant so far as the Titius Rule is concerned.

But there is an unexpected relevancy when we look to the distant past. There is a distinct possibility Pluto is not properly a planet at all, that it is instead an escaped satellite of Neptune! And if so, then

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we don't really have a planet to go into the 38.8 a.u. slot.

Impressive evidence supports the thesis. First is the fact that Pluto's probable radius of 2,650 kilometers is in the same order as Titan, Ganymede or Callisto. It is only slightly larger than the 2,000-kilometer radius of Neptune's major satellite Triton. The size is therefore about right for a satellite.

Then comes another peculiarity, the rotation period of the planet. Being so far from the sun, tidal effects would be negligible and any planet would retain its aboriginal spin unchanged over eons of time. Thus Jupiter spins once every 9 hours, 50 minutes. Saturn takes 10 hours, 14 minutes. Uranus 10 hours, 49 minutes and Neptune 15 hours, 40 minutes. Then comes Pluto with an absurd period of 6.39 days!

Clearly, something had to slow it down, and that can only have been some sort of tidal effect operating somewhere. The only visible way of providing a drag of this magnitude is to assume Pluto was once a satellite of Neptune in a 6.39-day orbit. Then the period would be synchronous with the rotation and one problem would be solved.

Perhaps the most impressive bit of evidence in support of this thesis is Neptune's major moon, Triton. It looks quite normal as moons go. Its radius of 2,000 kilometers is a bit large but not exceptionally so. The eccentricity of the orbit is zero to four decimal places, which makes it as nearly perfect as possible. The period about Neptune is a nice 5.87 days and its orbital distance from the planet is 353,600 kilometers.

But now comes the clinker . . . Triton travels *backward* in its orbit around Neptune!

Admittedly, there are a few other satellites which go the wrong way around their primaries. Jupiter has four retrograde satellites, having radii of 11.0, 28.0, 31.2 and 10.0 kilometers respectively. Their eccentricities are all greater than 0.13, or at least 13,000 times greater than Triton while their diameters are on the order of 1,000 times less.

Saturn adds one more to the collection. Little Phoebe is a moonlet with a diameter of 150 kilometers and an e of 0.166. It is also nearest of the other retrogrades to its primary, being a mere 13 million kilometers from Saturn, or some 30 times further out than Triton.

In short, the other retrogrades are small, highly eccentric in orbit and very distant from their primaries. Current belief is they were all captured at some time in the past. But the possibility of Triton having been captured is so slight as to be virtually nonexistent. We are therefore left with the inadmissible conclusion it must have formed *in situ* around Neptune only traveling backward in orbit. Clearly, there is a need for an alternative choice.

R. A. Lyttleton of Cambridge

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University put it all together. He began with the assumption that Pluto was originally a satellite of Neptune in 6.39-day orbit some 500,000 kilometers distant. Triton was also a regular satellite of Neptune in normal orbit at perhaps 600,000 kilometers. Gravitational interaction caused the two satellites to converge until eventually Triton and Pluto whipped about one another in near collision, with Triton winding up in a lower, circular, retrograde orbit about Neptune while Pluto was cast off as a runaway satellite.

The orbit of the ex-satellite would naturally reflect its point of origin so we would expect it to have a perihelion close to Neptune's orbit. Further, as Triton and Pluto would have a common birth in their present configuration, we would also expect them to have similar inclinations in their respective orbits. And sure enough, Pluto has an exceptionally high 17°.13 inclination, far higher than any other planet in the system. Triton matches this with an inclination of 20°.10 ± 2°.3. Subtract Uranus' own inclination of 1°.77 and we arrive at a relative value of 18°.33 ± 2°.3 for Triton; phenomenally close to Pluto. Lastly, nothing in all this would change the angular momentum of Pluto itself, so the new planet would continue to possess a 6.39-day rotation period as a memento of its dependence on Neptune.

All in all, this is a convincing argument. Everything winds up being explained in terms of simple, easily understandable mechanics. If correct, Pluto does not belong as the ninth planet. It simply chanced to get there by accident. And if this is the case, then for there to be planets at 58.0 and 77.2 would imply the existence of some planet *other than Pluto at approximately the mean orbital distance of Pluto!* It would have to be this as yet undiscovered planet which fills the Titius Rule slot at 38.8.

This is not an impossible requirement. The sidereal period of a planet in orbit at 38.8 is in the neighborhood of 250 years. In the 42 years since discovery we have observed Pluto over only 1/6 of a single orbit. There is therefore a distinct possibility another planet could exist in the same approximate orbit as Pluto without our having discovered it. There are, after all, some thousands of minor planets in the asteroid belt, so another planet at 38.8 is by no means out of the question. The chances are it would not be more than twice Pluto's diameter or it would have shown up in the extensive planet searches sponsored by the Lowell Observatory, but this would still make it nearly terrestrial in size and mass, so it would be no mean object.

When we start talking about the likelihood of such a planet, that becomes a different matter. The extensive searches by Tombaugh

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might appear unlikely, but he by no means blinked all segments of the heavens, so there is a reasonable possibility such a planet might exist. If it is as small or smaller than Pluto, and at a distance of 8B.S. a.u., there is a good chance it would have been missed even on a direct search. (Pluto was about 34 a.u. from the sun when it was discovered.) A planet of the same size at 50 a.u. would be 450 million miles more distant and only about 1/81 as bright. But this isn't the point. We have no right to postulate extra planets just for the fun of it. There should be some real reason or we are simply playing games and it becomes an exercise in pure speculation. So we must ask if there is some empiric reason to postulate one or more extra planets orbiting beyond Pluto.

This is a difficult question to answer. For example, it is entirely possible to explain away the disturbances in Uranus' orbit in terms of inaccurate early observations mated to highly accurate later ones. Thus the residuals Lowell used would all be imaginary and there would be no significance to the mathematical results he achieved. We could even argue there was a positive emotional push for astronomers of the last century to interpret any vagrant residual as evidence of more distant, undiscovered planets. The successes of Herschel, Adams and Leverrier testified to the honors awaiting the discoverer of a new planet, and ambitious astronomers were eagerly seeking ways of joining the select group.

This is the argument being advanced today by those who feel Lowell's calculations were merely a lucky chance. We admit the strength of the argument. But we must also note that the modern pressure is in precisely the opposite direction. The young mathematician of today scurries around in the mathematics of Lowell and others, picking up a residual here, another residual there, and tacks them all together in the presence of "uncertainties," and finally pronounces that he can explain Lowell's "error."

Of course, all he has done is assume that all errors accumulated over the years were "positive" with no "negative" errors to balance. This is highly unlikely. The thought of competent observers over a stretch of two centuries all making the same sort of error in total ignorance of each other boggles the imagination. It just isn't likely. Lowell's computations retain a definite attraction. No matter how cavalierly dismissed, there remains a powerful suspicion he said something worth listening to. And if so, at least one more planet must exist beyond Neptune.

Recent items in *Sky and Telescope* (November 1972, page 297) and *Computer Decisions* (June 1972, page 4) relate to the hypothesis of Joseph L. Brady and Edna Carpenter, of the University of Califor-

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nia's Lawrence Radiation Laboratory, who postulate a planet of 300 Earth masses orbiting at 59.9 a.u. and inclined 120° from the ecliptic. They derive these values from observed discrepancies in the return of Halley's Comet as reported from A.D. 295 to the present.

Unfortunately, a direct scan and blink comparison of the predicted location fails to disclose a planet. Further, rediscussion of the apparitions of Halley's Comet tends to throw doubt on the dates adopted by Brady, so here again it looks like a standoff.

But there is still another line of argument; one used by Brady but still not made explicit by him. This argument derives from the theory of comet "families." Going back a bit, the best evidence today suggests that the entire solar system is englobed by a cometary "halo," consisting of some 50 million comets in slow orbit about the sun at distances ranging from 30,000 to 50,000 a.u. This works out to perhaps one cometary mass for each volume of space equal to a sphere with a radius the size of Earth's orbit about the sun.

Occasionally one of these bodies interacts with another and both are perturbed out of their circular orbit. If the perturbation is less than escape velocity for the system, both bodies are fated ultimately to plunge inward toward the sun in a long, elliptical orbit. Generally these orbits are so eccentric the comet will have a period running into the millions of years.

But if the circumstances are just right, at some point on its inward plunge or outward return to the depths of space the comet will be perturbed by one of the planets, such as Jupiter. When this happens, the period of the comet is shortened and it becomes a reflection of the period of the perturbing planet. Thus we have the jovian "family" of comets, having periods of 10 years or less, a Saturn "family" with periods ranging from 10 to 20 years, a Uranus family of 20 to 40 years, and a Neptune family of 40 to 100 years. According to Table V, 39 comets belong to the jovian family, six to the Saturn family, three to Uranus and five to Neptune. *Then there are two others with periods which appear consistent with a planet at 58.0 a.u.!*

Actually, we can probably add three more comets to the 58.0 family. These are Swift-Tuttle, found in 1862, with a period of 119.6 years, Barnard (2), found in 1880, with a period of 128.3 years, and Mellish, discovered in 1917, with a period of 145.3 years. The comets on Table V have all been observed through more than one apparition and so have fairly reliable orbits established, but these three have been observed only once apiece and have somewhat doubtful orbits. It is unlikely that any of these three has had its orbit so badly misjudged as to be completely out

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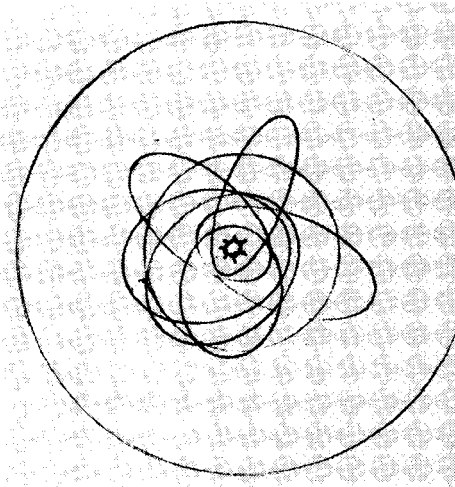
of the area so we can probably feel fairly safe in attributing five comets to the 58.0 a.u. family.

But like almost everything in astronomy, we can argue with the conclusions. Objectors to the idea of comet families point to the high inclinations of such objects as Halley's Comet and argue that Neptune could not possibly be of significance in modifying the orbit. They maintain that the real culprit of virtually all periodic comets is Jupiter. They further maintain that plucking off decades of time and claiming some sort of mysterious connection with the planets is mere numerology.

On the balance, this is one place where the argument of the objectors is clearly the stronger of the two. There is no doubt that the theory of comet families is correct as stated, but the application should almost certainly be restricted to comets on approximately the same plane as the planets influencing them. Halley's Comet, for instance, passes within 4.6 a.u. of Jupiter, but it never comes within 25 a.u. of Neptune. Clearly, the influence of Jupiter will be vastly the greater of the two. For that matter, the influence of the Earth and Venus, and perhaps even lowly Mercury, would outweigh that of Neptune. So to think that Neptune is somehow responsible for the orbit is to miss the whole point of the matter.

To this point the question of additional planets seems inconclusive, with the balance apparently leaning against the prospect. However, there is one line of reasoning which has not to my knowledge been ad-



Plots of 6 of Jupiter's family of comets. The outer circle is the orbit of Saturn. The sun is at the center and Jupiter is on the circular track between the two. No effort has been made to depict the orbits of any of the inner planets.

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vanced elsewhere but which I feel is highly suggestive.

The existing model of the solar system calls for a region of planets extending outward from the sun to Pluto, or roughly 40 a.u. Then we have a blank region until we enter the realm of the comet halo between 30,000 to 50,000 a.u. Being generous, let us postulate a halo doubled in size including all the space between 10,000 to 50,000 a.u. This still leaves a conspicuous gap in the region between 40 to 10,000 a.u., or possibly even between 40 to 30,000 a.u.

To suggest this is all void space would be, I suspect, wholly incorrect. It would be almost impossible to explain such a void by any me-

TABLE V. (Cometary orbits)

name	period years	perihelion dist. a.u.	aphelion dist. a.u.	eccentricity	date
1. Encke	3.30	0.34	4.09	0.847	1961
2. Grigg-Skjellerup	4.91	0.86	4.92	0.703	1961
3. Honda-M,-P.	5.21	0.56	5.46	0.815	1954
4. Tempel (2)	5.26	1.36	4.69	0.549	1962
5. Neujmin (2)	5.43	1.34	4.79	0.567	1927
6. Brorsen	5.46	0.59	5.61	0.810	1879
7. Tuttle-G.-K.	5.48	1.12	5.10	0.641	1951
8. Tempel-Swift	5.68	1.15	5.21	0.638	1908
9. DiVico-E. Swift	5.86	1.39	5.11	0.572	1894
10. Tempel (1)	5.98	1.77	4.82	0.463	1879
11. Pons-Winnecke	6.16	1.16	5.56	0.655	1951
12. Kopff	6.32	1.52	5.32	0.556	1958
13. Giacobini-Zinner	6.42	0.94	5.97	0.729	1959
14. Forbes	6.42	1.54	5.37	0.553	1961
15. Perrine (1)	6.45	1.17	5.76	0.662	1909
16. Wolf-Harrington	6.51	1.60	5.37	0.540	1958
17. Schwassmann-Wachmann (2)	6.53	2.16	4.83	0.383	1961
18. Biela	6.62	0.86	6.19	0.756	1852
19. Daniel	6.66	1.46	5.62	0.586	1950
20. Wirtanen	6.67	1.62	5.47	0.543	1961
21. D'Arrest	6.70	1.38	5.73	0.612	1950
22. Perrine-Mrkos	6.71	1.27	5.87	0.644	1962
23. Arend-Rigaux	6.71	1.39	5.73	0.611	1957
24. Reinmouth (2)	6.71	1.93	5.18	0.457	1960
25. Brooks (2)	6.72	1.76	5.36	0.505	1960
26. Harrington (2)	6.80	1.58	5.60	0.559	1960
27. Holmes	6.86	2.12	5.10	0.412	1906
28. Johnson	6.87	2.26	4.97	0.375	1956

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chanical means. If we postulate a comet halo, pushing the solar system out to 50,000 a.u., then we must be prepared to accept responsibility for explaining vast expanses of emptiness if and as they occur. In short, if the solar system ends at 40 a.u. or 50 or 60 a.u., for that matter, then we are free of the need to explain why the region immediately beyond it is empty. But if we accept the halo, we must also accept the implications of our reasoning and be prepared to talk about the gap between the planets and the halo.

So far as the comet halo is concerned, the evidence for its existence is nearly conclusive. Only two or three comets ever observed had

name	period years	perihelion dist. a.u.	aphelion dist. a.u.	eccentricity	date
29. Finlay	6.90	1.08	6.17	0.703	1960
30. Borrelly	7.02	1.45	5.88	0.604	1960
31. Faye	7.38	1.61	5.97	0.576	1962
32. Whipple	7.42	2.45	5.16	0.356	1955
33. Ashbrook-Jackson	7.51	2.32	5.34	0.394	1956
34. Reinmuth (1)	7.65	2.03	5.74	0.478	1958
35. Arend	7.79	1.83	6.03	0.534	1959
36. Oterma	7.88	3.39	4.53	0.144	1958
37. Schaumasse	8.18	1.20	6.92	0.705	1960
38. Wolf (1)	8.43	2.51	5.78	0.395	1959
39. Comas Sola	8.59	1.78	6.61	0.576	1961
40. Väisälä	10.46	1.74	7.82	0.636	1960
41. Neujmin (3)	10.95	2.03	7.83	0.588	1951
42. Gale	10.99	1.18	8.70	0.761	1938
43. Tuttle	13.61	1.02	10.38	0.821	1939
44. Schwassmann-Wachmann (1)	16.10	5.54	7.21	0.131	1957
45. Neujmin (1)	17.97	1.55	12.17	0.774	1948
46. Crommelin	27.87	0.74	17.64	0.919	1956
47. Tempel-Tuttle	33.18	0.98	19.67	0.905	1866
48. Coggia-Stephan-Oterma	38.96	1.60	21.39	0.861	1942
49. Westphal	61.73	1.25	29.98	0.920	1913
50. Brorsen-Metcalf	69.06	0.48	33.18	0.971	1919
51. Olbers	69.57	1.18	32.65	0.930	1956
52. Pons-Brooks	70.86	0.77	33.47	0.955	1954
53. Halley	76.03	0.59	35.31	0.967	1910
54. Herschel-Rigollet	156.00	0.75	57.22	0.974	1939
55. Grigg-Mellisa	164.30	0.92	59.08	0.969	1907

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orbits which were hyperbolic, and even these were just barely so. If comets were coming in from outside the system, a clear majority would have hyperbolic orbits, and most of those would be wide hyperbolas, not just marginally so as we find them in our few examples. This is as nearly conclusive as we can hope to get under the circumstances. I know of no contemporary astronomer who seriously doubts the existence of the halo.

This means we must be prepared to discuss the "empty" space between 40 and 10,000 or more a.u.

For my part, I postulate that this region is occupied by literally hundreds of thousands, or even millions of minor asteroids and planetoids possessing radii on the order of 150 to 1,500 kilometers with a few having radii up to roughly 3,000 kilometers and perhaps five or six with radii ranging upwards of 10,000 kilometers. Inclinations and orbits are random in the same sense that comets in the halo appear to possess random inclinations and orbits. There is so much space out there, and motions are so slow, that no systematic scouring has occurred and conditions remain nearly primeval.

Several arguments lead to this hypothesis. A fairly clear line of evidence indicates that planets condense from clouds which contain substantial amounts of particulate matter. A glance at the scarred faces of the moon and Mars is more than adequate to establish this argument and a view of the asteroid belt provides added proof if needed. To suggest that all this particulate matter was confined within a region of some 40 a.u., while simultaneously assuming the comets occupied all space beyond would appear more nearly an article of faith than reason.

Secondly, suppose Lyttleton's hypothesis of the origin of Pluto is correct. If so, this reduces the size of the system to around 30 a.u. and forces the correlary assumption that at this distance there was enough particulate matter to form the nucleus for the condensation of Neptune, Triton, Pluto, and tiny Nereid (radius 150 kilometers) which was obviously a capture from further out. To argue that Nereid was the last such item left over and there is now nothing until we get out to the comet halo requires a truly titanic act of faith on our parts.

A third line of reason goes back to Brady and Lowell. If we postulate a very considerable amount of random particulate matter beyond Neptune, then we can arrive at perturbations which give us a vector solution whenever we try to resolve them down to a single object. The discordant mass of Pluto becomes readily understandable as constituting an appreciable fraction of the masses acting on Uranus, but not necessarily the only remaining mass. And Brady's Saturn-sized mass at 58.0 a.u., which is

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otherwise invisible to telescopes, becomes simply another vector solution. It is a sum of forces rather than an actual object, so naturally there is nothing there to be seen.

A more remote argument comes from the "lost mass" of the galaxy. The physical mechanics of the galaxy require a mass of matter fully 20 percent greater than that we can observe or infer. Such material presumably exists in the form of black bodies, singularities, sub-dwarf stars, planets, free gases, comets, et cetera. We add all this together and still arrive at a shortage of roughly 10 percent. There is just that much mass missing somewhere.

Conventionally we find our solar system depicted as consisting of a sun and nine planets plus some miscellaneous objects such as comets, asteroids and satellites. The miscellaneous objects combined would not equal the mass of Earth and the sum of all the dark objects of the system is less than one percent of the mass of the sun. Postulating the existence of the intermediate belt between the inner system and the comet halo changes all this. An aggregate mass several times that of Jupiter could easily exist in this area without being detected, providing it was broken up into enough small fragments. A hundred thousand lunar-sized planetoids would equal 26 Jupiters in mass and would more than adequately account for the "lost mass" of the galaxy, at least so far as our one system is concerned. If this construction were typical of all solar systems, the "lost mass" question ceases to be a problem.

So now the matter is turned around. When we began we were talking about the prospects of another planet or two out beyond Pluto. But instead of one or two it turns out the real argument is for the existence of thousands, or hundreds of thousands of planets and asteroids, some of which are in all likelihood approximately the size of Earth.

Styx there is, and Charon too, and stones without number. It's a big, big solar system! ■

ABOUT THE AUTHOR

George Harper has trekked into the Caura River country of Venezuela, instructed in arctic survival in northern Alaska, guided a survey party in southwest Alaska, and roamed the southern Yucatan searching out the homeland of the Mayas. He was an air route traffic controller with the FAA, then quit to serve a brief stint as director of a small observatory. In the process he taught courses in astronomy at several local colleges and still teaches on occasion at Tacoma Community College.

On the astronomy scene, he has a rather detailed study under way touching on some of the unresolved fundamentals of the universe, such as what is mass, or how is an impulse transmitted through mass.

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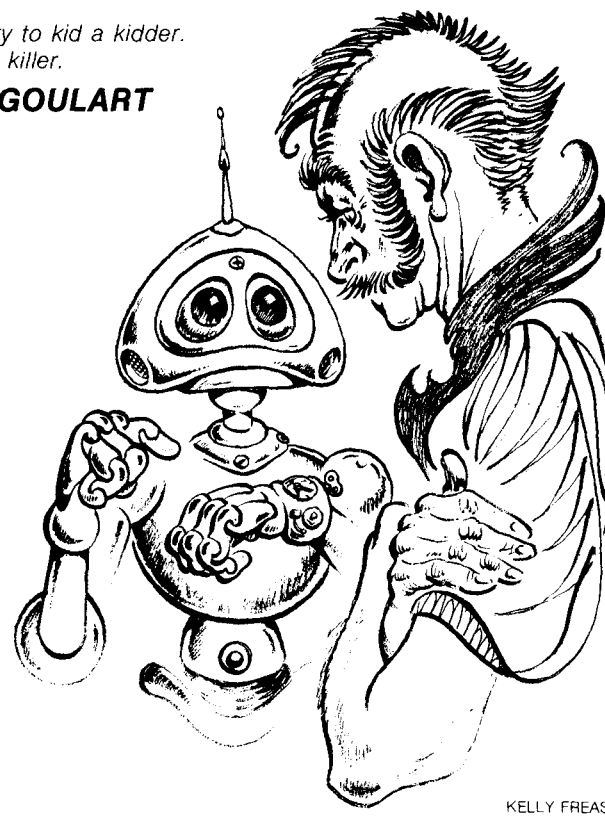
Regarding Patient 724

Never try to kid a kidder.
Or kill a killer.

RON GOULART



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The robots were harder to fool than the lizards or the humans. When he heard an android rolling toward the door of his hospital room Bernie Rolfe went bounding across the pseudotile floor. He jumped into the air-cushion bed, slipping the three folded fifty-dollar bills under his far buttock.

Seated on the windowsill, Associate Dr. Gennifer, an enormous human, gave a rumbling sigh as the money disappeared. "Darn it," he said, wiping jelly tart crumbs from his notched chin.

"Well, how are we this morning, Reverend Saboya?" asked the copper-colored android who wheeled into Rolfe's private room.

"It's three o'clock in the afternoon," replied Rolfe, who was pretending to be Reverend Francis Xavier Saboya.

The wheel-footed android rolled until he hit against Rolfe's soft bed. He then whanged his metallic side with a copper fist. "That's typical of the Gamela Territory Hospital," he said. "Build ninety thousand dollars' worth of ocular equipment into it, then skimp and stick in a fifteen-dollar watch." He made a sound like a vacuum cleaner sucking up pebbles. "Well, I hope you'll enjoy your stay with us, Reverend. Now then, how long have you been blind?"

"I'm not blind," said Rolfe.

The android looked at a pix-screen built into the palm of his hand. "You'll find a handicap easier to live with if you face up to it. Look at me . . . oops, that's not the thing to say to a blind man . . . consider me. I've learned to live with a cheap watch in my works."

Calling Dr. Nork, calling Dr. Nork, said a grid mounted high in the pale blue room.

"My problem isn't blindness," said Rolfe. "I had myself admitted yesterday at the suggestion of my bishop, because I've been seeing visions."

Fat Dr. Gennifer snorted, then reached out to take the last filbert torte off Rolfe's snack tray.

"Oh, that sort of vision problem." The android made a sound like an egg beater working on gravel. "Do you think you really need an oculist at all?"

"I don't know," replied Rolfe. "I'm entirely in your hands, you hospital people. This is all mostly my bishop's idea." He sat up, looking beyond the munching human doctor on the sill. The territorial hospital was triangular, built around a thick decorative jungle park. From his third-floor room in Ward 20 Rolfe could see, over the yellow and orange treetops, the part of the hospital which must house Ward X. The place he had to get to.

"You probably aren't even color blind?" asked the oculist android. "They just built a lot of really nice color blind tests into my elbow. I could project a few on the wall."

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Dr. Mangus, report to Wilderness Therapy. Dr. Mangus, report to Wilderness Therapy.

Rolfe said, "My trouble is that while I was out fasting in the desert last week I had a vision. I witnessed a whole choir of angels up in the sky, singing hosannas."

"I don't know much about music," said the android. "Still that's an unusual thing to see, isn't it?"

"Such was my feeling," said Rolfe. "However, when I reported it to my bishop he was less than enthusiastic. He has an inordinate fear of bogus miracles and he suggested I come here and have myself thoroughly tested before we make news of my vision public. He suspects it may simply be a hallucination."

Nodding his head, the android asked, "Are you still seeing these angels?"

"No," said Rolfe. "Though once in a while I do spot a cherub or two, very small ones, floating around at the edge of things."

"Really? Do you see them clearly? They aren't fuzzy or blurred."

"No, they seem quite sharp."

"Then you probably don't even need glasses."

Dr. Gennifer, your chocolate cream balls are ready. Dr. Gennifer, your chocolate cream balls are ready.

Grunting himself up, the enormous associate doctor moved to a wall phone. "This is Dr. Gennifer. Send those chocolate balls up the food chute to Room 302." He patted the android's shoulder on the way back to the sill. "I don't think you'll be needed any further on the reverend's case. Don't you have other calls to make?"

"Well, I have a couple of blind blues singers to comfort up in Ward 43," admitted the copper-colored android, rolling back from the bed on his small, slightly rattling, footwheels. "Still, I'd hate for the Central Computer to get down on me for neglect of duty."

"I'll put in a good word for you." A two-foot square door in the wall near the window made a hum. "Excuse me, this will be my pastry."

"Would you at least like some eyedrops?" the android asked Rolfe. "I can squirt eyedrops out of my little finger."

"No, thanks."

"Well, God bless you, Reverend."

"Same to you."

When the android rolled out into the hall fat Dr. Gennifer was kneeling, puffing, at the low food-chute opening. "You could have made up a more conventional fake malady," he told Rolfe.

"My experience has been that it's good to be a little audacious," said Rolfe. "Besides, we happened to have the reverend's identification packet."

The chute delivered a plate out to Gennifer. "This is sliced streusel

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roll you've sent up, you ninnies," he yelled into the open food hole. "Darn it."

Swinging out of bed, Rolfe asked, "What else have you found out about Lloyd McMaxon?"

"Did you hear me, you poops?" Dr. Gennifer was shouting into the chute through cupped hands. "Sliced streusel roll is sure not my idea of chocolate cream balls."

Rolfe nudged the squatting doctor with his toe. "You can go into the capital of Gamela Territory and buy a hundred and fifty dollars worth of chocolate cream balls if you have some more to tell me about McMaxon."

Wheezing, the fat Gennifer pushed down on his enormous thighs and got himself upright. "No. I wouldn't blow the whole amount on chocolate cream balls. I'll probably spread it out over jelly doughnuts, cinnamon buns, macaroon jam slices, madeleines, brownies . . ."

Rolfe jabbed the doctor's arm with the fist holding the money. "Where have they got McMaxon?"

"He's in Ward X, as I suggested last night. Just a moment." Grunting, he knelt again. "I might as well eat this stupid streusel as long as they sent it." He withdrew the plate of sliced pastry, carried it to the wide high windows.

"You're sure McMaxon isn't in the Prison Wing?"

"You paid me fifty bucks to find out where Lloyd McMaxon was. I did. They've got him over in Ward X."

"What room is he in?"

Biting into his nut-crusted cake, Dr. Gennifer said, "I still haven't found that out. Remember I have sixty-four other patients to look after. Most of them aren't fakes like you and I really have to work my butt to the bone to handle my case load."

Rolfe hid the money away into a concealed pocket in his all-season shorts. "Do you have any idea why McMaxon isn't in with the other prisoners they're treating here?"

"Probably because they consider him a political criminal," said Dr. Gennifer. "It's mostly everyday crooks in the Prison Wing. This McMaxon belongs to those Uptown Commandos who plague the capital, doesn't he?"

"So I've heard." There was no need for the associate doctor to know Rolfe was with the UC himself.

Sucking his ring and middle fingers, Gennifer said, "They're using phenylalanine in this topping instead of real rich creamery butter, but even so the stuff isn't bad."

Gennifer wiped his free hand on his white pullover medical smock, then raised it with fingers outspread. "I don't have the clearance for that, to find out what they're up to over there. Some kind of government-funded project is all I know."

Rolfe asked, "They wouldn't be

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uh . . . interrogating him . . .?"

"Heck no," the fat doctor assured him. "Our planet of Tarragon subscribes to the Barnum System Accords, after all. You're not allowed to go using sophisticated query equipment on a political prisoner anymore, even an alleged urban guerrilla like McMaxon." He made his little blue eyes go as wide as they could. "Are you afraid of what he'll say to somebody?"

Rolfe shook his head, pressing lean fingers against the paper money concealed in his shorts. "My reasons for talking to him don't have to concern you."

"So long as you assure me you don't mean to do him any harm."

"Of course I can assure you that," smiled Rolfe, who'd come into the Gamela Territory Hospital to kill McMaxon.

Dr. Gennifer, wanted in the pastry kitchen. Dr. Gennifer, wanted in the pastry kitchen.

"Maybe they can clear up the chocolate cream ball confusion." The enormous doctor started for the exit.

"Find out what room McMaxon is in," said Rolfe. "And how I can get in to see him."

"I'll give it a try." The fat doctor held out his fat hand. "How about fifty bucks up front?"

"O.K., but get me some results by tomorrow."

Dr. Gennifer got the bill wadded into a tight trouser pocket just as Nurse Clumm came shuffling into the room. "You're doing fine, Reverend," said the fat doctor from the doorway. "I'll drop in on you again tomorrow."

"Up and around, eh?" said Nurse Clumm. She was a ninety-two-year-old lizard woman cyborg. "Central Computer doesn't have you down for Up&Around yet, Reverend. Pop back into bed."

Rolfe sat on the edge of the bed. "Ever work over in Ward X?"

"Couldn't tell you if I had," replied the old green-blue lizard woman. "Now let's get your pulse and temperature." She pressed his wrist with a scaly thumb.

"I thought maybe . . ."

"Open up," requested the nurse. She jabbed the forefinger of her metallic right arm into his mouth. There was an oral thermometer built into the finger.

Six of them ringed Lloyd McMaxon's wheelchair. Dr. Trollope, the middle-aged neobiologist lizard man who headed the Anthropomorphic Tactics Center of the Gamela Territory Hospital; Surgeon General Sheldonmayer, the small wrinkled-up human who had something to do with the territorial government; Combat Nurse Wordsmith, a lovely six-foot-tall blond with an always-flushed face; and three cat men in ill-fitting floor-length medical smocks.

By stretching, McMaxon, a plump blond man of thirty, could see over their heads and watch the

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late afternoon sky from his tenth-floor window.

"Would you like to check the latest X-rays of your foot?" the brownish-green Dr. Trollope asked him. He had a sheaf of black pictures under his arm.

"No." McMaxon decided to look at Combat Nurse Wordsmith, who reminded him a little of Elena.

"You'll be on your feet again in no time," said the lovely blond nurse.

Keeping his wrinkle-rimmed eyes aimed at his white boots, Surgeon General Sheldonmayer said, "Uh . . . what exactly does no time indicate? I mean . . . uh . . . how long before this fellow . . . uh . . . can go sweeping through Peralta Territory and visiting doom on our prickchinking enemies, who even now . . ."

"We're all very happy about the way your foot is mending so nicely, Lloyd," said Dr. Trollope. "What's even better, your volunteer job for the Anthropomorphic Tactics Center is coming along at a much more rapid rate than we'd anticipated. I should say you'll be primed and ready in another few short days."

"Uh . . . ready to spread justly-deserved destruction on our jiggle-boned opponents across the border?"

"Yes sir," the lizard doctor told the surgeon general. "I'd like you to meet some of the other chaps from ATC. Here are Dr. Gowdy, Dr. Pagsilang and Dr. Tchin-Veblen. Come to take a friendly gander at you."

"How do you do," said McMaxon, automatically holding out his hand.

"Wait," cautioned the lizard. "Dr. Gowdy can shake your hand and so can Dr. Tchin-Veblen. Dr. Pagsilang, however, hasn't had his final booster."

"I'd just as well skip it, too," said the cat man in the middle of the trio of cat-man doctors.

"That's what I said. Dr. Pagsilang can bypass."

"I'm Dr. Tchin-Veblen." The middle cat man rested his furry cheek against his shoulder so he could read his name tag. "Oh, I seem to have slipped into Dr. Pagsilang's robe by mistake. Here, Phil."

"That's O.K., Burt, we can change back in the barracks wing," said the calico-colored Dr. Pagsilang.

"No, I don't like to wear other people's things. It makes me feel crawly." Dr. Tchin-Veblen began unzipping his long white smock.

Dr. Gowdy asked, "How did you break your foot, Mr. McMaxon?"

"Escaping," answered McMaxon.

"Mr. McMaxon is an urban terrorist," the lovely warm-looking nurse explained. "He and his fellow Uptown Commandos—correct me if I misinterpret your views in any way, Mr. McMaxon—believe in overthrowing our territorial govern-

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ment by force and violence and replacing it with a neosocialistic ruling committee. Is that about right so far?"

McMaxon nodded. "Yep."

"My zipper's stuck, Burt. Couldn't we forget about switching?"

"Not on your life. Come on, tug the thing."

"Mr. McMaxon's guerrilla friends and he have been bombing government buildings, destroying central heating systems, derailing monorail trains, kidnaping key officials . . . anything else?"

"*Assassinating policemen,*" added McMaxon. "And we have a hot-lunch program for senior citizens."

The lovely nurse snapped her warm-looking fingers. "I forgot the most important part. The Uptown Commandos also commit robberies to finance their other works. It was while running away from one such that Mr. McMaxon fell and injured himself."

"Well, pull it off over your head then."

"Don't jerk at the hem, Burt. I don't care for people pawing my garments."

"You were subsequently captured then, Mr. McMaxon?"

"That's right, yes." McMaxon went along with all the UC rules, but he believed Bernie Rolfe, who was still on the supermarket copter pad when he tripped over the robot boxboy, could have come back for him. Well, maybe McMaxon was too critical of him because Rolfe had been seeing Elena just before she quit the movement.

"Don't pull so hard, Burt. Now you've got it crumpled and gathered around my throat and face. I might smother."

Dr. Gowdy gave McMaxon a tentative pat on the arm. "Considering your political viewpoint, I think it's terrific of you to volunteer to help the government this way."

"They promised to drop the charges against me if I did this," said McMaxon. "You may not know it but committing a robbery to aid a political cause is a crime punishable by death in our territory, especially during wartime."

"Oh, really?"

Watching his white-booted toes, the surgeon general said, "Uh . . . if this fellow didn't play ball with us . . . uh . . . he'd be standing against a wall about now . . . uh . . . waiting for blaster rifle beams to come sizzling at him and burn enormous gaping and fantastically painful holes into his person."

"Don't clutch like that, Burt. You're pulling out great tufts of hair."

"You should pay better attention to whose robe you go gadding about in."

Dr. Trollope took a step toward McMaxon. "Have you been having night sweats or stool problems, Lloyd?"

"No, sir."

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"[illegible] what difference does that make? [illegible] uh . . . I mean [illegible] uh [illegible] a compact and deadly human weapon like this fellow . . . uh [illegible] who cares about his bowel movements?"

"We're also trying to answer many questions which aren't of a military nature during these experiments," said the brown and green lizard.

"O.K. Burt, it's off. Here."

"We'll leave you now, Lloyd," said Dr. Trollope. "Is there anything I can do for you?"

"Well, you might see if I can have more vegetables at meals. I'm trying to give up meat."

"I'll take care of that," said the lovely combat nurse.

McMaxon nodded at all of them, then guided his chair over to the windows. He was at the pseudo-glass watching the tangle of decorative jungle far below, before the last doctor was out the door of Room 224.

The enormous Dr. Gennifer sat himself down on the edge of Rolfe's air-filled bed, causing Rolfe to rise up high. "I'm not much of an artist," said the fat doctor.

"Where were you yesterday?"

"Central Computer had you down for a day of fasting," replied Gennifer. "I don't like to be around for things like that." He unfolded the sheet of paper he'd pulled out of a side pocket in his medical tunic.

"Apparently the food chutes didn't know you weren't going to be stopping in here yesterday. They sent you a half-dozen blueberry turnovers."

"Did you keep them?"

"In my bedside cabinet."

Chuffing off the bed, Gennifer bent, with a groan, and opened the cabinet. "I only see four."

"I ate two."

"That isn't right when you're supposed to be fasting."

"I'm not really sick at all, remember? I'm in here under false pretenses. My real purpose is to contact Lloyd McMaxon over in Ward X. I'm bribing you to help me."

"Don't keep reminding me of my venality." The enormous doctor grabbed a turnover with each hand.

"I'm reminding you of what I paid you to find out."

Tossing the paper to Rolfe, Gennifer said, "Have a look."

Rolfe brushed pastry flakes off the thin sheet of paper. It was a rough architectural plan. "Why do I want a drawing of the hospital food center?"

"See the red dot."

"It's marking the pastry kitchen. Damn it, Gennifer, can't you . . ."

"Wait now." The fat doctor located another drawing in another pocket. "This is the companion piece."

Rolfe studied the new sheet of paper. "This is the floor Ward X is on, huh?"

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"Exactly. I had to spend over half of what you've given me to get it," said Gennifer as he finished the first turnover. "Notice the little broken blue line I've put on both drawings. That's your route."

Rolfe followed the line with his middle finger. "From the food center to the pastry kitchen, then across to the wing over there by way of the food delivery ramp. From there . . ."

Dr. Busino wanted in Cryptobiosis. Dr. Busino wanted in Cryptobiosis.

"From there up through the food chute to the Doctors' Mess on the tenth floor."

"The chutes over there are somewhat larger, so you'll have no trouble ascending."

"You've got me ending up in someplace labeled . . . I can't make out the word."

"Kennels."

"Kennels?"

"Where they keep the animals."

"Animals for what?"

Gennifer shook his head, scattering powdered sugar from his cheeks. "It would take a good deal more than the teeny-weeny bribe you gave me to buy so much information, Reverend. They must be using the animals for some of their experiments in X"

"O.K., so I pay you three hundred dollars altogether and I end up in a dog kennel."

"They've got all kinds of animals there I think, not only dogs. Twice a day, or possibly thrice, a jitney-load of experimental animals goes into Ward X. The process is automatic, no live personnel involved. There is a late evening delivery of animals to be used the first thing the next morning. Should you be able to conceal yourself aboard that specific jitney you'll end up at the spot I've marked with a green cross."

"There's no green cross."

"Oh, that's right. I got called away to perform a knee operation before I finished annotating. Here, I'll show you." The enormous doctor poked at the floor plan. "There's the Pre-Test Room."

"You still don't know which room McMaxon is in?"

"There are only a dozen or so patients in all of Ward X, far as I've been able to find out. Even if you have to hunt and peck, it shouldn't take you all that long to nose him out."

"O.K.," said Rolfe. "What do these orange blotches on the map signify?"

"Disregard those, it's some filling from an apricot horn." replied Gennifer. "But do trace the yellow line. There's your exit route. By way of the scrap disposal system."

"I'm supposed to get out with the garbage?"

"It's the best escape route I could arrange, unless you want to wait around all night in Pre-Test and ride back on the empty robot jitney after your talk with McMaxon."

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After his talk with McMaxon Rolfe wanted to get out of the ward, out of the entire hospital, as soon as possible. The Penultimate [illegible] of the Uptown Commandos had decided McMaxon, like his native girl friend Elena, wasn't reliable enough. He couldn't be left in the hands of the territorial government. Even if the government men were following the rules of the Barnum Accords, McMaxon might decide to give them information. Rolfe had told the colonel he might be able to get McMaxon out of the hospital and back to them, but they'd voted, seven to three, to take the simpler course. "I'll use the chute," said Rolfe.

Surgeon General Sheldonmayer was speaking to his boots. "Uh . . . far be it from me to violate the mollycoddling conventions of the prickchinking Barnum Accords, Patient 724 . . . uh . . . can I call you Lloyd?"

McMaxon rolled himself a few feet back from the view. The noon glare, bouncing off the jungle park, made his plump pale face glow orange and yellow-green. "Sure, General. He and the wrinkled little military medical man were alone in his Ward X room.

"Lloyd, it would be a nice gesture if you'd tell us all you know about the rumpsplitter organization you're affiliated with . . . uh . . . names of all the membership, addresses, pixphone numbers . . . any fiendish plots they're cooking up."

Shaking his head, McMaxon said, "I have a certain loyalty to the Uptown Commandos, General, even though I'm going along with this experiment."

"Uh . . . I admire your pigheaded dedication to your cause, even though the cause is full of beans," said Sheldonmayer. "However . . . uh . . . I was hoping you'd change your mind when I made it . . . uh . . . crystal clear to you exactly what you can expect from those guerrilla comrades of yours. Uh . . . as an example of how they treat their people . . . uh . . . look what they did to . . . uh . . . this Elena somebody or other." The wrinkled man held four small photos toward McMaxon.

"What?" He rolled across to take the little color pictures.

"Uh . . . these aren't the best photos I've ever seen. The Territorial Police are trying out some reconditioned photojournalism robots and . . . uh . . . the tugmutton things jiggle too much . . ."

McMaxon looked at the top picture, then tried to stand up on his broken foot. "Christ!" he said, stumbling and falling to his knees.

"I thought you'd given up slapping patients, Sheldonmayer," remarked Dr. Trollope as he came into the room.

"Uh . . . don't be a plugtail,

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Doc." With McMaxon on the floor the surgeon general found he was looking directly into his eyes. He moved away.

The green-brown lizard physician strode quickly over to help McMaxon back into his wheelchair. "You mustn't be overanxious, Lloyd. Plenty of time to learn to walk again. Ah, what are these?" He took the photos as McMaxon, paler than ever, went slumping back into the bright metal frame. "I'd say a severe case of drowning. Notice the bloated condition of the body . . ."

"Yang!" McMaxon made his chair roll close to Sheldonmayer. "When did they find her?"

"Uh . . . yesterday afternoon."

"Where?"

"You . . . uh . . . should have studied the entire set of pics. There's one in there which, despite its fuzziness, gives you . . . uh . . . a good idea of the location."

"Yes, here we go." Dr. Trollope had shuffled through the pictures of the dead Elena. "You're right, Sheldonmayer, the quality of the photos isn't that good." He brought the picture close to his scaly face. "Yes, this is obviously the lagoon in the Generalissimo Vurmo Memorial Park."

"I thought it was simply the Generalissimo Vurmo Park," said tall, lovely Combat Nurse Wordsmith. She had a white rabbit under each arm.

"No, it's been the Generalissimo Vurmo Memorial Park since last Tuesday," said Dr. Trollope. "Tuesday being the day the generalissimo was assassinated."

"I should really keep more up on current events," sighed the warm-looking nurse. "What with my top secret duties here in Ward X and a full and well-rounded social life I just—"

"Who killed her?" McMaxon asked the wrinkled surgeon general. He knew Elena was to have gone to the park with Bernie Rolfe on the night she disappeared. Rolfe had told him she never showed up there. No one had seen her since.

"Uh . . . who do you think? . . . look at the way she's tied and at . . . uh . . . the marks on her neck, there . . . a typical urban guerrilla mode of killing."

"I hadn't noticed those neck marks or the ropes," said Dr. Trollope, going through the pictures of Elena's body once again. "You're right, Sheldonmayer. This complicates my original theory of simple drowning."

Nurse Wordsmith cleared her lovely throat. "What about the bunny rabbits, Doctor?"

McMaxon was breathing slowly through his mouth. He frowned at the nurse. "I don't want any pets."

"These little rascals aren't pets, Lloyd," said the lizard doctor. "If you can postpone your business with Lloyd, Sheldonmayer, we'll get on with our test."

"Uh . . . yes. I'm as anxious as

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you are to . . . uh . . . unleash this human weapon on our enemies across the border."

"Lloyd," began Dr. Trollope, "we believe you're just about ready, after the initial series of treatments and tests, to function for us in a paramilitary capacity."

"You want to try me out on the rabbits?"

"Right you are." The lizard doctor beckoned the nurse nearer. "According to the last virulence rating on you, Lloyd, you are now a fully-functioning carrier of Anthropomorphic Tactics Center's synthetic virus RS-036-Strain 14."

McMaxon said, "Anybody I touch gets it?"

"I . . . we intensely hope so, Lloyd." The surgeon general reached out to nuzzle the nearest rabbit. "Uh . . . I confidently look forward to the day when we have a hundred or . . . uh . . . two hundred RS-036 carriers roaming the countryside of Peralta Territory, spreading . . . uh . . . fatality and pestilence in their . . . uh . . . wake."

"Touch one of the bunnies," suggested pretty Nurse Wordsmith.

McMaxon hesitated.

"The first time is always the most difficult." Dr. Trollope smiled with his thin scaly mouth.

"Here goes." McMaxon missed the rabbit on the first grab and his hand smacked Nurse Wordsmith's right breast. "Excuse me."

"Don't blush. It's an understandable mistake. Here, I'll hold this bunny out closer to you."

McMaxon gingerly rubbed his palm along the soft furry back of the right-hand rabbit.

"In the case of human beings," pointed out Dr. Trollope, "we expect a longer period of time before the disease takes effect. We can't have them pitching forward the minute you shake hands or pat them on—"

The white rabbit screamed once, stiffened and died. It quickly turned an oily black color.

"Uh . . . very good."

Nurse Wordsmith puckered her lips, looking for someplace to drop the dead rabbit. Its mate took advantage of the girl's distraction to leap free of her grasp.

"Uh . . . the cunning fellow is making a break," cried the wrinkled little surgeon general, zigzagging around the room after the hopping rabbit.

"Toss that one in the dispozhole under the bed," suggested Dr. Trollope. He had his scaly hands locked behind his back and was chuckling happily. "Our RS-036 works even better than I anticipated. I can hardly wait until we smuggle you across into Peralta Territory for some field tests."

"On people?"

"That was part of our agreement, Lloyd," the lizard doctor reminded him. "You know, we all have to do things we don't think we like. Why, not a day goes by—"

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"Uh . . . the little jigger's got out into the corridor." Surgeon General Sheldonmayer dived out the partially open door of Room 724 after the leaping lab rabbit.

"Shall I fetch the frogs next?" asked the lovely nurse.

Dr. Trollope scratched his chin, making a dry raspy sound. "Let's bypass the frogs and get right to the dogs."

"I have to kill dogs, too?"

"Only two or three."

"What kind of dogs?"

"I don't actually know. Do you, Nurse Wordsmith?"

"A cocker spaniel and two Venusian huskies."

McMaxon said, "I had a cocker spaniel named Sparky when I was a kid. He ran off after an ice-cream vending robot and we never saw him again."

"It's unlikely this is the same cocker. And, as I was just saying, we all have to . . ."

"I caught him!" The wrinkled little Sheldonmayer trotted back into the room, clutching the white rabbit by the ears.

Rolfe arrived in the Doctors' Mess smelling of nut bars and *petits fours.* He'd had to crouch in a pastry kitchen storage cabinet for an hour before the associate pastry chef Dr. Gennifer had bribed thought it was safe for Rolfe to make his way across the food ramp. It took Rolfe ten minutes to climb up the metallic ropes dangling in the narrow shadowy chute.

He caught the edge of the delivery slot—it was marked "10" on the chute side—and eased its sliding panel open a half inch.

He heard crunching in the dim room beyond.

"Uh . . . I hate going into the capital for those *junta* press conferences . . . uh . . . it's so prick-chinking tedious . . . By the . . . uh . . . time an eight-man *junta* explains itself . . . uh . . . hours elapse," a faint tired voice was saying.

"I kept your tray on the hot plate, sir," said a robot serving boy.

"Uh . . ."

Hanging in the food chute, Rolfe waited. It sounded as though the man with the weary voice was munching crackers, meaning he was probably only on the soup course.

"Uh . . . I don't suppose Nurse Wordsmith is still up at this hour . . . uh . . . must be close to midnight."

"Only twenty past eleven, sir," replied the serving mechanism. "I believe the young lady flew into the capital to attend a masked ball at the Department of Agriculture. I saw her going toward the descend chute two hours ago dressed as a sack of organically grown wheat and wearing a domino mask."

Carefully Rolfe shifted his grip. He was holding to a cable with his left hand and to the delivery opening rim with his right. Someone had spilled soymayonnaise and for

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an instant his right hand went slurring across the edge of the opening.

He hung there in the food-scented dark for twenty-five minutes flexing and shifting every few minutes.

How about another one of these *babas au rhum*, sir?"

"Uh . . . too many *babas* and I uh . . . get a pain."

You ought to see a doctor."

Four more minutes passed, then the tired man left the dining room.

The robot cleaned up, turned out the rest of the overhead light strips and shuffled out.

Rolfe waited a full minute longer before opening the panel full wide and swinging into the large darkened room. He dropped to the long serving table below the opening. His foot squished on something soft and spongy, which he figured must be a *baba au rhum*.

He jumped to the floor, edged across the dining room, listening. From far off came the noise of a robot falling down. There was no other sound.

Rolfe had gone over his plans again while hanging in the food chute. Once he found McMaxon he had to quickly give him the impression he'd come to get him out of there. Be friendly and then, when McMaxon was off guard, use the coil of plastic cord he'd swiped back down in the second-floor supply closet. With Elena it had been simple because she'd believed him to be interested in her. Meeting him in the park that night had seemed romantic to her. Well, there shouldn't be any trouble convincing McMaxon they were still friends, comrades in arms.

As he was about to leave, Rolfe noticed a side door marked Meal Coordination. He worked the door

The Analytical Laboratory

August 1973

PLACE	TITLE	AUTHOR	POINTS
1.	The Far Call (Pt. 1)	*Gordon R. Dickson*	2.00
2.	The Epoxy Goat	*David Lewis*	3.41
3.	Forty Days and Nights	*Robert Chilson*	3.56
4.	Stimulus-Reward Situation	*Gene Fisher*	3.79
5.	The Jungle	*Karl Hudgins*	3.80
6.	The Sweet Smell of the Past	*Lawrence A. Perkins*	4.08

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open. The compact computer built into the wall was a low-grade one, simple-minded, and it told him what he wanted to know without any protest. Lloyd McMaxon was on a vegetable diet, which he was served at six, twelve, and five. He was in Room 724.

The animal jitney was on automatic. Rolfe found it sitting in the kennel area, already loaded with the five animals scheduled to go into Ward X. Rolfe had brought a meat patty and some synthcarrots in his pocket, but the animals in the trunk-size jitney wagon were all sleeping a drugged sleep.

The lock on the barred rear door was simple to open. Rolfe was still getting himself huddled in a corner, covered with two shaggy albino squirrels and a long-haired goat, when the jitney made a clacking sound and commenced to roll.

It rolled by a human guard who was asleep at the force screen entrance to Ward X proper. The jitney automatically broke the invisible screen, which ceased its low sizzling for the ten seconds it took the wagon to roll across the wide threshold. The guard did not awaken.

Once in the dark Pre-Test Room Rolfe nudged the snoring goat off, slipped out of the cage.

The corridor which held rooms 721-726 was empty and silent, except for one hanging speaker grid which was making a soft high-pitched clucking.

Rolfe, running on tiptoe, headed for the door of 724. He listened at the door, then tapped gently and went in.

"Who is it?"

This was McMaxon all right, sitting up in his bed in the moonlit room's center. "It's me, Lloyd. It's Bernie."

"Bernie Rolfe?"

"What other Bernie do you know who'd go through all this to get you out of here?"

McMaxon didn't answer.

Closing the door at his back, Rolfe eased closer. "I know you may be a little annoyed with me, Lloyd. For leaving you at the market. You know, though, what the Uptown Commandos feel about such situations."

"Sure, I know."

"Everything is going to work out now," said Rolfe. "Because here I am. We'll get you out of here with no trouble."

"I appreciate that, Bernie, I really do."

With his left hand, the one farthest from McMaxon, Rolfe reached out the looped cord. "I'm glad you're in such good shape, Lloyd. I'm glad you're reacting this way. I had a moment when I thought maybe . . ."

"We weren't still friends?"

"Right," said Rolfe. "But we are still friends, aren't we?"

"Sure, we are," said McMaxon in the moonlit darkness. "Let's shake hands on it, Bernie." ■

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Creativity takes place in the mind. A creative person must be, above all, a person.

SONYA DORMAN

The last of the triple moons was still in the sky at dawn, when Pettrey woke. A fine, greenish haze predicted a good day, one of clear light. He stretched luxuriously, though he must get up quickly, eat some excellent nourishment, and be on his way. It was licensing week.

The first two days, given over to apprentices, had passed, while Pettrey took his time, took walks, admired rivers, and allowed his mind to go easy. He had suffered the hours of anxiety, as he did every year, and put them behind him. Very likely they would reappear in another form, later on; he used everything in one way or another.

After he had eaten, Pettrey put a fairly new cloak over his shoulders, and left home. The rivers were running silver green in the park where he lived this year. Although it was so early in the day, the roads were busy. Many shops closed during the mornings of licensing week, for apprentices earned their bread at any other trade until the license was granted them, and during this week, few customers came to the stores. It was much more amusing, if a person was free, to attend one of the many tests.

The huge rotunda of performing arts rose in the near distance; Pettrey could see the doorway was clogged with spectators, trying to get in early for good seats. He sighed, and smiled a little. It was good to be alive. Even for those scared apprentices, the people turned out in rousing crowds. The performing artists, unlike Pettrey, depended on the presence of responsive crowds.

As the road widened, he joined and passed groups of people. There, up ahead, he saw the figured gray cloak of Massony, come such a surprising long way since last year's granted license. Pettrey found it difficult to squeeze the anxiety, even jealousy, from his heart, but managed to do so, as he came alongside the other man.

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"Ah!" Massony said, looking around. He liked to greet people with this slightly portentous sound, and it nearly always worked; they would be silent, hang on, wait for some revelation.

"Lovely day," Pettrey said, and walked on just enough faster to get ahead and blend with the crowds.

The building he went to was small and looked insignificant, for his work demanded isolation rather than an audience. There was the check-in booth, where he put down his now expired license, signed his name, was told he was third, and took a seat to wait. Massony did not come in while Pettrey waited, so he supposed the younger man was entertaining people outside, in that way he had.

"Ah!" An important, breathy sound, and everyone would hang on, waiting for Massony to give them something they could pass around to less lucky friends.

Massony was only a few years younger than Pettrey, but had started late, having spent his early years in agriculture, and come only recently to the arts. Pettrey had often thought that might account for his rapid rise to popular proficiency. The genuine force of Massony's work must have been within him all those years, like an egg long incubated before the phoenix was hatched.

No, that's not right, Pettrey complained to himself, folding the cloak over his knees, keeping his eyes on the door where he would enter. *That bird never hatched from an egg,* Pettrey reminded himself. He sighed deeply. He had spent a long apprenticeship, had come to this building many times, and had failed many times, before his license was granted. Different ways for different men, he thought. Not receiving a license didn't prevent a person from singing or playing the violin, of course; it simply kept him out of public performances and prevented him from taking money under false pretenses.

A perfectly beautiful young woman came in and sat down in the waiting room. Pettrey looked at her with pleasure. But she said, "The Master is outside, talking with people."

Good God, Pettrey thought: *the Master!* It was an obsolete term, and he had never heard it used by young people at all.

"Are you one of his students?" Pettrey asked her.

"Yes," she said, and refused further communication by leaning her head back and closing her eyes.

Pettrey thought it a shame to waste that much beauty in his field, and immediately amended his thoughts, though he couldn't have helped them. It was simply that he liked to see beauty displayed in the performing arts, and didn't enjoy thinking about it hidden in some private burrow such as his own. But then, after a certain number of years . . . what was that kind of

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beauty worth? . . . compared to his own.

He had no idea how long he must wait; it could be half an hour or half a day, depending on the person before him. At any rate, he'd been here on time, and had spent yesterday morning supporting the apprentice singers with his presence. One or two of them had been quite fine, so it hadn't been a loss for him.

But after all these years, Pettrey was still astonished at how many came to be licensed, how many with no talent, no beauty, nothing but a little bit of a dream. The purpose of licensing was to prevent these people from overflowing in a difficult field, and from swindling the interested public. He could not imagine a better system, even if he fell victim to it. Not if he looked at it objectively.

The entry door swung open, a clerk spoke his name, and vanished.

Pettrey went into the inner room, which was smoothly paneled, well lighted at the writing table, and quite plain, except for the huge chandelier in the center of the ceiling. In the dark, still air, the prisms and crystals hardly stirred, though just his quiet progress across the room to the table caused a small coruscation to occur.

He appreciated the absence of any presence, as he thought of it. He sat down in the comfortable chair, and lined up the writing tools, of which there was a good selection. He fingered the various papers. A new one, this year, with a kind of pale fiber running through. Pettrey thought it might have been begged from a draftsman, it was so nice both to eye and hand. As always, he reached for the plain student block, which was most familiar and comfortable to him.

Now he began his discipline, for which he had been prepared; but nothing went right. The moment he began to breathe evenly, his mind cavorted off, tara-taroo, like a child at recess. How the rivers ran silvery over the white moss. How last week Memee had said to him, "Oh, Pettrey, I'd love you even if you worked in stone."

As if I did not, Pettrey thought acidly, answering her a little too late. For what he must do, figuratively speaking, was to create a lace from adamant rock, to make a lively and flexible dancing slipper from a ton of metal. He could feel it, cold and dead, weighing down his mind.

Now, discipline, Pettrey told himself.

Tra-la, tra-loo, we are the sons of Bingaloo, went his mind.

Pettrey cursed aloud.

He sat in the pool of light at the table, physically comfortable, quite alone as he wished to be, and died his many deaths. What if it had gone. What if it never came back. What if he could not produce a

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word today, but woke up next morning and poured out a masterpiece one day too late? What if he lost his license? What if he could make love to Massony's beautiful student?

Picking up a gernsey point, he wrote one line of exceedingly erotic poetry and crossed it out in a rage. That was not his *métier*, that kind of celebration too narrow, and as a person grew older, less challenging. He had already accomplished that so many times.

Pettrey sat back in the chair and closed his eyes, giving his mind freedom. The clichés came to seduce him: worn images, damaged phrases, jingles, and that hideously intrusive children's rhyme about Bingaloo. A mythical, rhythmic country, where children dwelled.

He began to breathe at a slower rate. His mind wandered further from its rational tether. For a moment the little invisible valve in his forehead opened, then it closed again, but he knew it was a start.

No matter how deeply at work or at rest Pettrey was in his chair, he resisted even the slightest thought of the chandelier hanging still as death above him. Before his first license, he had learned all about it: the computer buried in the ceiling, the delicate calibrations which responded to increased electrical activity of a certain kind in the brain, recording quality only, whether of five lines or ten pages, and the stories of great poets, how they remembered the colors and flashing which occurred on their finest occasions.

Memee had said to him, "Oh, Pettrey, why can't we settle down somewhere and be like other people." Though she knew he didn't wish to settle down, and that term "other people" was meaningless to him, since no person was another person, and he was most entirely himself.

Again he took up the gernsey point, with its soft gray writing unit, and began to work in earnest, which meant that for the first time since entering the room he was able to smile a little, to be amused at his own problems, which he should be used to by now. A little self-consciousness remained to him at first, until seven or eight lines were written.

Very gradually, he worked in deeper and deeper, feeling the imaginary valve in his forehead open wide so that the ancestral memories, the images of dream and superconsciousness, could be freed for use. A little fire appeared in the room near the ceiling above him. One prism twinkled. Another shimmered. The lines he wrote grew more dense and he threw the finished page to the floor and took up a new one.

Prisms, like antlers, grew upward from his forehead. Fire flickered and danced, growing more rapid and intricate. The whole chandelier, enormous flame cage of

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glassy spires, crystal stalactites, loosening teardrops, began to wink and flare, began slowly to swing in ponderous and gorgeous rhythm above him.

Pettrey went on writing his poem. The recordings taken by the computer, masked as a decorative unit, would be read and filed and licensed. There was no one in the room to watch the prisms give off their radiance, no one to appreciate the flashings that would fall still as soon as the poet ceased writing. Perhaps Pettrey was aware of the dance above him, but only on a deep and quiet level. What he really felt, while he worked, was a profound sense of love, a form of praise, perhaps, rising from his heart. He was unaware that it bypassed his conscious mind entirely, and would have denied that, if someone told him about it.

Pettrey did think he might go on forever, at this rate, and asked nothing more of life than that he should do so, but abruptly, and long before he was ready, the work was finished. He knew it by instinct. Anything he might add now would be a frivolity, and would have to be cut later on.

He put down the gernsey point. He picked up the sheets of paper he had thrown to the floor, and placed them, neatly folded, in the inside pocket of his cloak. He supposed they would be worth publishing, after a period of cooling off, and some weeks of polishing. In any event, it wasn't necessary for them to be seen by anyone in their rough stage.

Pettrey was happy. The sense of love remained with him. It was not love of himself as an individual, but love of his place in the world, and the joy of what he was able to do. He wished everyone well, Massony, younger men, and the oldsters. Glowing, he crossed to the exit door, which led him out to the other side of the building. Two young men, both of them evidently successful, were having refreshments near the door.

"Come and join us," they invited him.

"No, thank you, I'm going to wait outside for a friend," Pettrey said. "Thank you, though. It's been a good day, hasn't it, gentlemen?"

Whether it was the strength of their drinks, or whether their testing had been over for too long a time, he didn't know, but in spite of their hearty invitation, they looked sideways at him. He recognized the old green faces of envy and aspiration, which so often went together. Though he knew there was no reason for it, there was enough room for them all. The license to practice one's art guaranteed that.

Pettrey had told the truth about waiting for a friend; he just did not feel like remaining indoors. There was a bench near some colorful flowers and he sat down there, with the edge of his eye on the door.

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After a while, the two young men came out together and walked away. Pettrey almost snoozed, utterly relaxed.

Hunger made him come to, and he glanced at the day, green and bright around him. But after all, he was not that old, to run home for a meal at the first hunger pang, and as he had planned to wait, no matter how long, he did so. Not without a twinge of wonder at himself, his possible folly.

I could have written a saga by now, he thought, when the exit door finally released her. She had a blind, stupefied look which he recognized with the utmost sympathy, and because of it, he fell into the same long, slow stride she took, without saying a word.

"I didn't understand before," she said, at last.

Pettrey was horribly tempted to say, "Ah!" in a meaningful voice, but controlled himself. Instead, he said, "It will have to be understood a dozen times over, you know. Will you come and walk to the river with me?"

She glanced at his face. The dazed look was gone; she now showed an evident sense of pride and of herself. "Yes, that would be nice," she said. Her smile was delightful as she added, "I'm certainly sick and tired of sitting at a person's feet."

Pettrey took her arm and they made swiftly for the russet-colored trees by the silvery green river. ■

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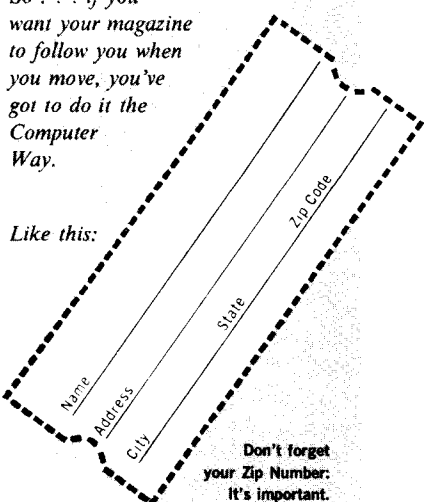

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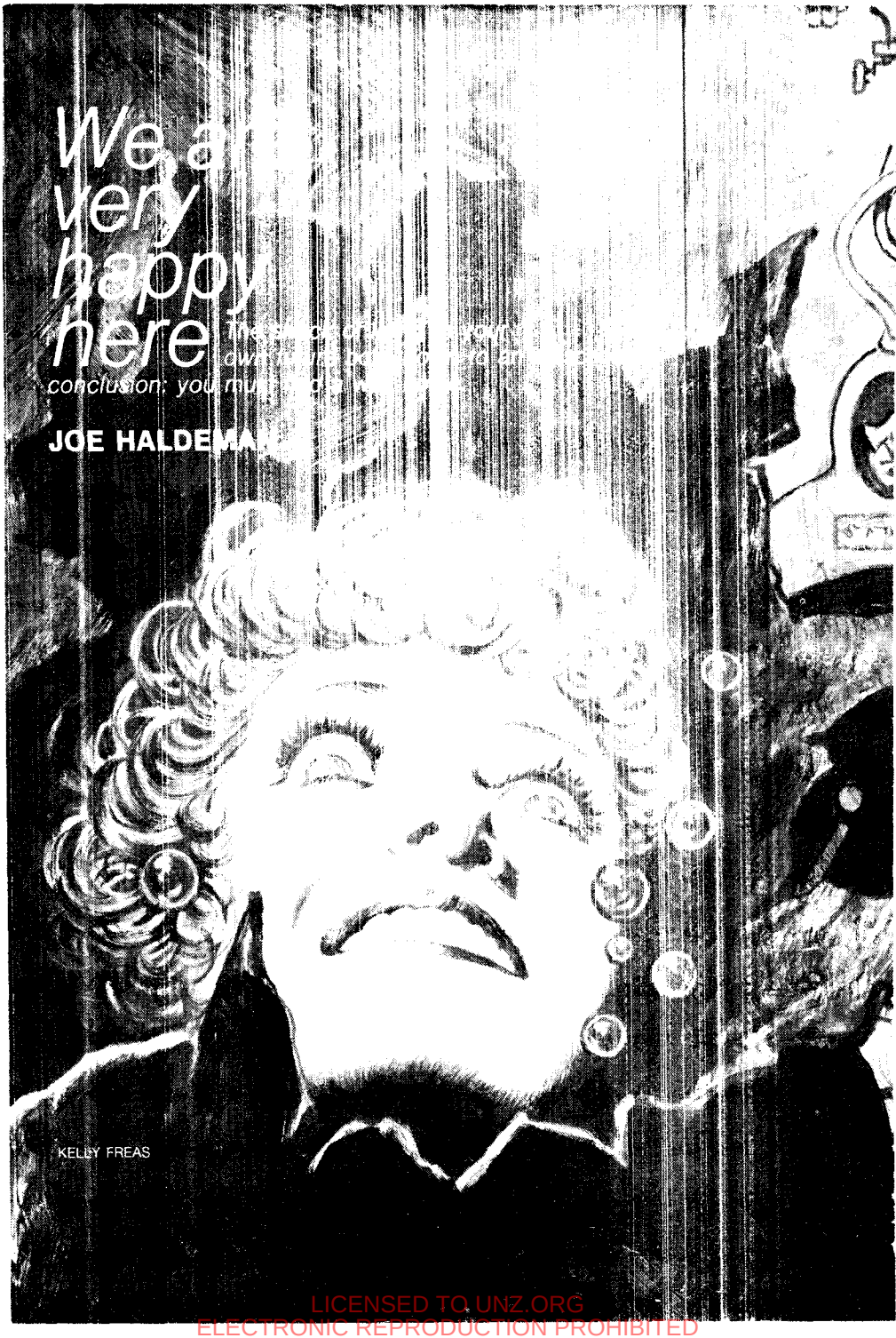

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Scared? Oh yes, I was scared—and who wouldn't be? Only a fool or a suicide or a robot. Or a line officer.

Submajor Stott paced back and forth behind the small podium in the assembly-room/chop-hall/gymnasium of the *Anniversary*. We'd just made our final collapsar jump, from Tet-Thirty-eight to Yod-Four. We were decelerating at one and a half gravities and our velocity relative to that collapsar was a respectable nine-tenths c. We were being chased.

"I wish you people would relax for a while and just trust the ship's computer. The Tauran vessel at any rate will not be within strike range for another two weeks and if you keep moping around for two weeks neither you nor your men will be in any condition to fight when the time comes. Fear is a contagious disease. Mandella!"

He was always careful to call me "Sergeant" Mandella in front of the company. But everybody at this briefing was a squad leader or more; not a private in the bunch. So he dropped the honorifics. "Yes, sir."

"Mandella, you are responsible for the psychological as well as the physical efficiency of the men and women in your squad. Assuming that you are aware of the morale problem building aboard this vessel *and* assuming that your squad is not immune . . . what have you done about it?"

"With my squad, sir?"

He looked at me for a long moment. "Of course."

"We talk it out, sir."

"And have you arrived at any dramatic conclusion?"

"Meaning no disrespect, sir, I think the major problem is obvious. My people have been cooped up in this ship, hell, everybody has, for fourteen—"

"Ridiculous. Every one of us has been adequately conditioned against the pressures of living in close quarters *and* the enlisted men have the privilege of confraternity." That was a delicate way of putting it. "Officers must remain celibate yet *we* have no morale problem."

If he thought his officers were celibate, he should sit down and have a long talk with Lieutenant Harmony. Maybe he just meant line officers, though: himself and Cortez. Fifty-percent right, probably. Cortez was rather friendly with Corporal Kamehameha.

"The therapists reinforced your conditioning in this regard," he continued, "while they were working to erase the hate-conditioning—everybody knows how *I* feel about that—and they may be misguided but they are skilled."

In our first battle with the Taurans, we had been so saturated with blind hatred that we'd massacred every last one of them, even though the object of the raid had been to take prisoners. Stott had stayed on the ship.

"Corporal Potter." He had to call

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[illegible] by [illegible]nk to remind everybody [illegible] hadn't been promoted along with the rest of us. Too soft. Have you talked it out' with your [illegible]?"

We've discussed it, Sir."

[illegible] could "glare [illegible] people. He glared mildly at Margaris until she continued.

"I don't think Sergeant Mandella was finding fault with the condi-"

"Sergeant Mandella can speak [illegible]self. I want your opinion. Your observations." He said it in a [illegible] indicated he didn't want them much.

"Well, I don't think it's the fault of the conditioning either, sir. We [illegible] any trouble living together. Everybody is just impatient, tired of doing the same thing week after week."

"We're anxious for combat, then?" No sarcasm in his voice.

"We want to get off the ship, sir, out of the routine."

"They will get off the ship," he said, allowing himself a small mechanical smile. "And then they'll be just as impatient to get back on."

It went back and forth like that [illegible] time. Nobody wanted to [illegible] the basic fact that our [illegible] had had over a [illegible] to the upcoming [illegible] only become more apprehensive. And [illegible] closer closing on [illegible] to take our chances [illegible] were within a [illegible] the ground assault.

The prospect of hitting that portal planet and playing soldier was bad enough. But at least you have a chance, fighting on the ground, to influence your own fate. This bullshit of sitting in a pod, just part of the target, while the *Anniversary* played mathematical games with the Tauran ship . . . to be alive one nanosecond and dead the next, because of an error in somebody's thirtieth decimal place, *that's* what was giving me trouble. But try to tell that to Stott. I'd finally had to admit to myself that he wasn't putting on a grisly little act. He actually couldn't understand the difference between fear and cowardice. Whether he'd been purposefully conditioned into that viewpoint—which I doubted—or was just plain crazy, it no longer mattered.

He was raking Ching over the coals, the same old song and dance. I fingered the fresh Table of Organization they had given us.

I knew most of the people from the Aleph massacre. The only new ones in my platoon were Demy, Luthuli and Heyrovsky. In the company (excuse me, the "strike force") as a whole, we had twenty replacements for the nineteen people we lost during the Aleph raid. One amputation, four deaders and fourteen psychotics; casualties of overzealous hate-conditioning.

I couldn't get over the "20 Mar 2007" at the bottom of the T/O. I'd been in the Army ten years,

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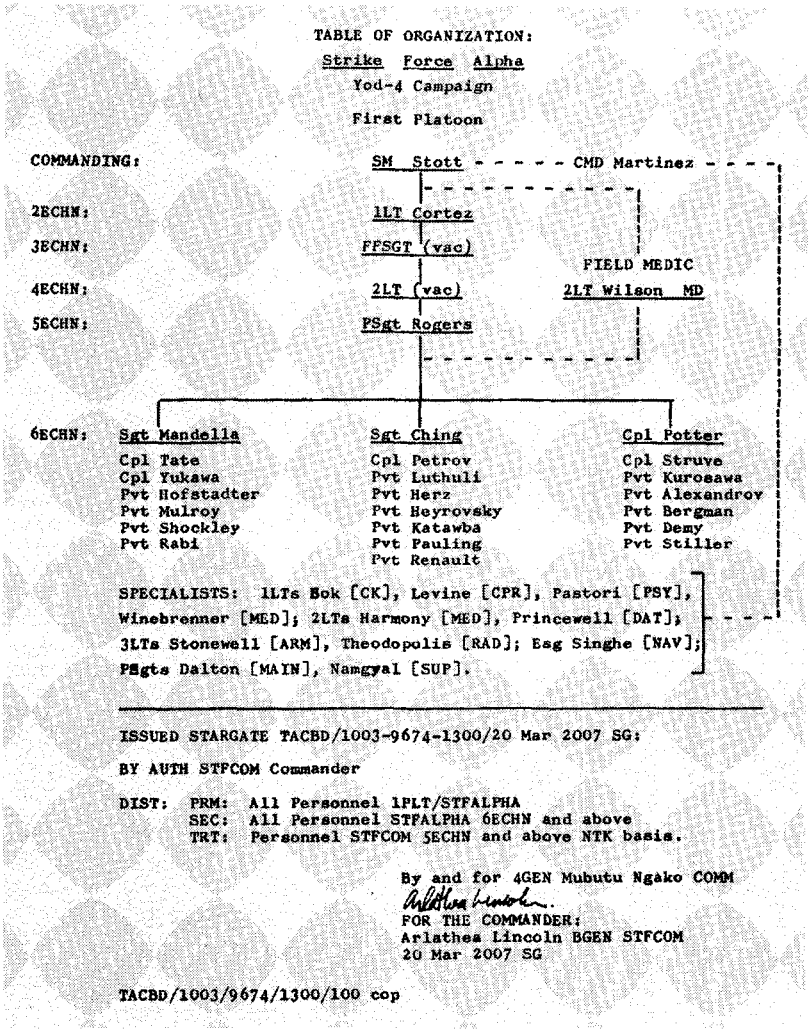
TABLE OF ORGANIZATION:
Strike Force Alpha
Yod-4 Campaign
First Platoon

COMMANDING: SM Stott - - - - - CMD Martinez - - - -

2ECHN: 1LT Cortez

3ECHN: FFSGT (vac)

4ECHN: 2LT (vac) FIELD MEDIC 2LT Wilson MD

5ECHN: PSgt Rogers

6ECHN:

Sgt Mandella	Sgt Ching	Cpl Potter
Cpl Tate	Cpl Petrov	Cpl Struve
Cpl Yukawa	Pvt Luthuli	Pvt Kurosawa
Pvt Hofstadter	Pvt Herz	Pvt Alexandrov
Pvt Mulroy	Pvt Heyrovsky	Pvt Bergman
Pvt Shockley	Pvt Katawba	Pvt Demy
Pvt Rabi	Pvt Pauling	Pvt Stiller
	Pvt Renault	

SPECIALISTS: 1LTs Bok [CK], Levine [CPR], Pastori [PSY], Winebrenner [MED]; 2LTs Harmony [MED], Princewell [DAT]; 3LTs Stonewell [ARM], Theodopolis [RAD]; Esg Singhe [NAV]; PSgts Dalton [MAIN], Namgyal [SUP].

ISSUED STARGATE TACBD/1003-9674-1300/20 Mar 2007 SG:

BY AUTH STFCOM Commander

DIST: PRM: All Personnel 1PLT/STFALPHA
SEC: All Personnel STFALPHA 6ECHN and above
TRT: Personnel STFCOM 5ECHN and above NTK basis.

By and for 4GEN Mubutu Ngako COMM
FOR THE COMMANDER:
Arlathea Lincoln BGEN STFCOM
20 Mar 2007 SG

TACBD/1003/9674/1300/100 cop

though it felt like less than two. Time dilation, of course. Even with the collapsar jumps, traveling from star to star eats up the calendar.

After this raid, I would probably be eligible for retirement, with full pay. If I lived through the raid, and if they didn't change the rules on us. Me a twenty-year man, and only twenty-five years old.

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[illegible] was summing up when [illegible] knock on the door, a [illegible] shout up. "Enter," he said.

[illegible] ensign I knew vaguely [illegible] casually and handed [illegible] slip of paper without saying [illegible]. He stood there while Stott [illegible] stamping with just the right [illegible] insolence. Technically, [illegible] was out of his chain of command; everybody in the Navy disliked [illegible] anyhow.

Stott handed the paper back to [illegible] ensign and looked through him.

"You will alert your squads that [illegible] evasive maneuvers will commence at 2010, fifty-eight minutes from now." He hadn't looked [illegible] watch. "All personnel will be [illegible] shells by 2000, [illegible]."

We nodded, without enthusiasm, and chorused "Hump you, sir."

Stott strode out of the room and the ensign followed, smirking.

I turned my ring to position four, the assistant squad leader's channel, and talked into it. "Tate, this is Mandella." Everyone else in the room was doing the same.

A tinny voice came out of the ring. "Tate here. What's up?"

"Get hold of the men and tell them we have to be in the shells by 2000. Evasive maneuvers."

"Crap. They told us it'd be [illegible]."

"I guess something new came up. Maybe the commodore has a bright idea."

"The commodore can stuff it. You up in the lounge?"

"Yeah."

"Bring me back a cup when you come. O.K.? Little bit of sugar?"

"O.K. Be down in half an hour."

"Thanks. I'll round 'em up."

There was a general movement toward the soya machine. I got in line behind Corporal Potter.

"What do you think, Marygay?"

"I'm just a corporal, Sarge. I'm not paid to–"

"Sure, sure. Seriously."

"Well, it doesn't have to be very complicated. Maybe the commodore just wants us to try out the shells again."

"Once more before the real thing."

"Mm-hm. Maybe." She picked up a cup and blew into it. She looked worried, a tiny line bisecting the space between her eyebrows. "Or maybe the Taurans had a ship 'way out, waiting for us. I've wondered why they don't do it, like we do at Stargate."

I shrugged. "Stargate's a different thing. It takes seven or eight cruisers, moving all the time, to cover the most probable exit angles. We can't afford to do it for more than one collapsar, and neither can they."

"I don't know." She didn't say anything while she filled her cup. "Maybe we've stumbled on their version of Stargate. Or maybe they have ten times as many ships. A hundred times. Who knows?"

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I filled and sugared two cups, sealed one. "No way to tell." We walked back to a table, careful with the rapid sloshing of the soya in the high gravity.

"Maybe Singhe knows something," she said.

"Maybe he does. But I'd have to get to him through Rogers and Cortez. Cortez would jump down my throat if I tried to bother him now."

"Oh, I can get to Singhe directly. We . . ." She looked at me very seriously and then dimpled a little bit. "We've been friends."

I sipped some scalding soya and tried to sound nonchalant. "That's where you disappeared to Wednesday night?"

"I'd have to check my roster," she said and smiled. "I think it's Mondays, Wednesdays and Fridays during months with an 'r' in them. Why? You disapprove?"

"Well . . . damn it, no, of course not. But--but he's an officer! A *Navy* officer!"

"He's attached to us and that makes him part Army." She twisted her ring and said, "Directory." To me: "What about you and cuddly little Miss Harmony?"

"That's not the same thing." She was whispering a directory code into the ring.

"Yes, it is. You just wanted to do it with an officer. Pervert." The ring bleated twice. Busy. "How was she?"

"Adequate." I was recovering.

"Besides, Ensign Singhe is a perfect gentleman. And not the least bit jealous."

"Neither am I," I said. "If he ever hurts you, tell me and I'll break his ass."

She smiled at me across her cup. "If Lieutenant Harmony ever hurts you, tell me and I'll break *her* ass."

"It's a deal." We shook on it solemnly.

II

The acceleration shells were something new, installed while we rested and resupplied at Stargate. They enabled us to use the ship at closer to its theoretical efficiency, the tachyon drive boosting it to over twenty-five G's acceleration.

Tate was waiting for me in the shell area. The rest of the squad was milling around, talking. I gave him his soya.

"Thanks. Find out anything?"

"Afraid not. Except that the swabbies don't seem to be scared, and it's their show. Probably just another practice run."

He slurped some soya. "What the hell. It's all the same to us, anyhow. Just sit there and get squeezed half to death. God, I hate those things."

"Oh, I don't know. They might make the infantry obsolete. Then we can all go home."

"Sure thing." The medic came by and gave me my shot.

I waited until 1950 and hollered

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the squad. "Let's go. Strip down and zip up."

The shell is like a flexible spacesuit, at least the fittings on the inside are pretty similar. But instead of a life-support package, there's a hose going into the top of the helmet and two coming out of the heels, as well as two relief tubes per suit. They're crammed in shoulder-to-shoulder on light acceleration couches, getting to your shell is like picking your way through a giant plate of olive-drab spaghetti.

When the lights in my helmet showed that everybody was suited up, I pushed the button that flooded the room. No way to see, of course, but I could imagine the pale blue solution, ethylene glycol and something else, foaming up around and over us. The suit material, cool and dry, collapsed in to touch my skin at every point. I knew that my internal body pressure was increasing rapidly to match the increasing fluid pressure outside. That's what the shot was for, to keep your cells from getting squished between the devil and the pale blue sea. You could still feel it though. By the time my meter said "two" (external pressure equivalent to a column of water two nautical miles deep), I felt that I was, at the same time, being crushed and bloated. By 2005 it was at two point seven, and holding steady. When the maneuvers began, at 2010, you couldn't feel the difference. I thought I saw the needle fluctuate a tiny bit, though, and wondered how much acceleration it took to make that barely visible wobble.

The major drawback of the system is that, of course, anybody caught outside of his shell when the *Anniversary* hits twenty-five G's would be just so much strawberry jam. So the guiding and the fighting have to be done by the ship's tactical computer—which does most of it anyway, but it's nice to have a human overseer.

Another small problem is that if the ship gets damaged and the pressure drops, you'll explode like a dropped melon. If it's the internal pressure, you get crushed to death in a microsecond.

And it takes ten minutes, more or less, to get depressurized and another two or three to get untangled and dressed. Not exactly something you can hop out of and come up fighting. Only four people have any mobility while the rest of us are trapped in our shells; that's the Navy maintenance crew. They essentially carry the whole acceleration chamber apparatus around with them, their suit becoming a twenty-ton vehicle. And even they have to remain in one place while the ship is maneuvering.

The accelerating was over at 2038. A green light went on and I chinned the button to depressurize.

Marygay and I were getting dressed outside. The residual fumes

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from the pressurizing fluid made me unpleasantly giddy and a little nauseous.

"How'd that happen?" I pointed to an angry purple welt that ran from beneath her right breast to the opposite hipbone.

"That's the second time," she said, pinching the skin angrily. "The first one was on my rear—I think that shell doesn't fit right, gets creases."

"Maybe you've lost weight."

"Wise guy." Our caloric intake and exercise had been rigorously monitored and controlled since suit-fitting at Stargate. You can't use a fighting suit unless the sensor-skin inside fits you like a film of oil.

A wall speaker drowned out the rest of her comment. "Attention all personnel. Attention. All Army personnel echelon six and above and all Naval personnel echelon four and above will report to the briefing room at 2130. Attention—"

It repeated the message twice. I went off to lie down for a few minutes while Marygay showed her bruise—and all the rest of herself—to the medic and the armorer. For the record, I didn't feel a bit jealous.

The commodore began the briefing. "There's not much to tell, and what there is, is not good news.

"Six days ago, the Tauran vessel that is pursuing us released a drone missile. Its initial acceleration was on the order of eighty gravities.

"After blasting for approximately a day, its acceleration suddenly jumped to a hundred and forty-eight gravities." Collective gasp.

"Yesterday, it jumped again. Two hundred and three gravities. I shouldn't need to tell you that this is twice the accelerability of the enemy's drones in our last encounter.

"We launched a salvo of drones, four of them, intersecting what the computer predicted to be the four most probable future trajectories of the enemy drone. One of them paid off, very near, while we were doing evasive maneuvers. We contacted and destroyed the Tauran weapon about ten million kilometers from here."

That was practically next door. "The only encouraging thing we learned from the encounter was from spectral analysis of the blast. It was no more powerful than ones we have observed in the past; so we might infer that at least their progress in explosives has not matched their progress in propulsion. Or perhaps they just didn't feel a more powerful blast was necessary.

"This is the first manifestation of a very important effect that has heretofore been of interest only to theorists. Tell me, soldier," he pointed at Negulesco, "how long has it been since we first fought the Taurans, at Aleph?"

"That depends on your frame of

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[illegible] she answered dutifully. "To me, it's been about eight months, Commodore."

"Exactly. You've lost about nine years through time dilation. That's why we maneuvered between collapsar warps. In an engineering sense, as we haven't done any important research and development during this period . . . that enemy vessel comes from our future!" He stopped to let that sink in.

As the war progresses, this can only become more and more pronounced. The Taurans don't have our quirk of relativity though, so it will be to our benefit as often as to theirs.

"For the present though, it is we who are operating with a handicap. As the Taurans pursuit vessel draws closer, this handicap will become more severe. They can simply outmaneuver us.

"We're going to have to do some fancy dodging. When we get within two hundred million kilometers of the enemy's ship, everybody gets in their shells and we just have to trust the logistic computer. It will put us through a rapid series of random changes in direction and velocity.

"That's blunt. As long as they have no more drive than we they can't touch us. They haven't caught us more since that first one. Perhaps they are holding their [illegible] mopped his forehead nervously. Or maybe they only *had* one. In that case, it's we who have them."

"At any rate, all personnel will be required to be in their shells with no more than ten minutes' notice. When we get within a thousand million kilometers of the enemy, you are to stand *by* your shells. By the time we are within five hundred million kilometers, you will be in them, and all shell compounds will be flooded and pressurized. We cannot wait for anyone.

"That's all I have to say, Submajor?"

"I'll speak to my people later, Commodore. Thank you."

"Dismissed." And none of this "Hump you, sir" nonsense. The Navy thought that was just a little beneath their dignity. We stood at attention all except Stott—until he had left the room. Then some other swabbie said "Dismissed" again, and we left. I went up to the NCO room for some soya, company, and maybe a little information.

There wasn't much happening but idle speculation, so I took Rogers and went off to bed. Marygay had disappeared again, hopefully trying to wheedle something out of Singhe.

III

We had our promised get-together with the submajor the next morning, where he more or less repeated what the commodore had said, in infantry terms and in his

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staccato monotone. He emphasized the fact that all we knew about the Tauran ground forces was that if their naval capability was improved, it was likely they would be able to handle us better than last time.

But that brings up an interesting point. In the only previous face-to-face contact between humans and Taurans, we'd had a tremendous advantage: they had seemed not to quite understand what was going on. As belligerent as they had been in space, we'd expected them to be real Huns on the ground. Instead, they practically lined themselves up for slaughter. One escaped, and presumably described the idea of old-fashioned infighting to his fellows.

But that, of course, didn't mean that the word had necessarily gotten to this particular bunch, the Taurans guarding Yod-Four. The only way we know of to communicate faster than the speed of light is to physically carry a message through successive collapsar jumps. And there was no way of telling how many jumps there were between Yod-Four and the Tauran home base—so these might be just as passive as the last bunch, or they might have been practicing infantry tactics for a decade. We would find out when we got there.

The armorer and I were helping my squad pull maintenance on their fighting suits when we passed the thousand million kilometer mark and had to go up to the shells.

We had about five hours to kill before we had to get into our cocoons. I played a game of chess with Rabi and lost. Then Rogers led the platoon in some vigorous calisthenics, probably for no other reason than to get their minds off the prospect of having to lie half-crushed in the shells for at least four hours. The longest we'd gone before was half that.

Ten minutes before the five hundred million kilometer mark, we squad leaders took over and supervised buttoning everybody up. In eight minutes we were zipped and flooded and at the mercy of—or safe in the arms of—the logistic computer.

While I was lying there being squeezed, a silly thought took hold of my brain and went round and round like a charge in a superconducter; according to military formalism, the conduct of war divides neatly into two categories, tactics and logistics. Logistics has to do with moving troops and feeding them and just about everything except the actual fighting, which is tactics. And now we're fighting, but we don't have a *tactical* computer to guide us through attack and defense, just a huge, super-efficient pacifistic cybernetic grocery clerk of a logistic, mark that word, logistic computer.

And the other side of my brain, perhaps not quite as pinched,

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would argue that it doesn't matter what name you give to a computer: it's just a pile of memory crystals, logic banks, nuts and bolts . . . if you program it to be Genghis Khan, it's a tactical computer, even if its usual function is to monitor the Stock Market or control sewage conversion.

But the other side was obdurate and said that by that kind of reasoning, a man is only a hank of hair and a piece of bone and some stringy meat; and no matter what kind of a man he is, if you teach him well you can take a Zen monk and turn him into a slavering bloodthirsty warrior.

Then what the hell are you, we on I answered the other side. A peace-loving vacuum-wielding specialist *our* physics teacher snatched up by the Elite Conscription Act and reprogrammed to be a killing machine. You'll have killed and liked it.

But that was hypnotism, motivational conditioning, I argued back. They don't do that any more.

And the only reason, I said, they don't do it is because they think you'll kill better without it. That's logic.

Speaking of logic, the original question was, why do they send a logistic computer to do a man's job? or something like that . . . and we were off again.

The light blinked green and I chinned the switch automatically. The pressure was down to one point three before I realized that it meant we were alive, we had won the first skirmish.

I was only part right.

IV

I was belting on my tunic when my ring tingled and I held it up to listen. It was Rogers.

"Mandella, check squad bay three. Something went wrong; Dalton had to depressurize it from Control."

Bay three—that was Marygay's squad! I rushed down the corridor in bare feet and got there just as they opened the door from inside the pressure chamber and began straggling out.

The first one out was Bergman. I grabbed his arm. "What the hell is going on, Bergman?"

"Huh?" He peered at me, still dazed, as everyone is when they come out of the chamber. "Oh, s'you, Mandella. I dunno. Whad'ya mean?"

I squinted in through the door, still holding on to him. "You were late, man, you depressurized late. What happened?"

He shook his head, trying to clear it. "Late? Late. Uh, how late?"

I looked at my watch for the first time. "Not too—" Jesus Christ. "Uh, we zipped in at 0520, didn't we?"

"Yeah, I think that's it."

Still no Marygay among the dim

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figures picking their way through the ranked couches and jumbled tubing. "Um, you were only a couple of minutes late . . . but we were only supposed to be under four hours, maybe less. It's 1050."

"Hm-m-m." He shook his head again. I let go of him and stood back to let Stiller and Demy through the door.

"Everybody's late, then," Bergman said. "So we aren't in any trouble."

"Uh—" *Non sequiturs.* "Right, right—Hey, Stiller! You seen—"

From inside: "Medic! MEDIC!"

Somebody who wasn't Marygay was coming out. I pushed her roughly out of my way and dove through the door, landed on somebody else and clambered over to where Struve, Marygay's assistant, was standing by a pod, talking into his ring very loud and fast.

"—God, yes, we need blood—"

Where Marygay had gotten a welt the last time we were in the pods, now she had a deep laceration, nearly a meter long, diagonally across her body. She was covered with a bright sheen of blood and it was still oozing out of the cut, filling the pod.

Clear air passages/stop the bleeding/protect the wound/treat for shock—I worried the first-aid kit off my belt while I checked her mouth; she was breathing all right. Cracked the seal on the bandage and unrolled it. It was a few centimeters short but would have to do, so I laid it gently down the length of the wound. It was saturated with blood by the time I fumbled out the ampoule of No-shock, laid it against her arm and pushed the button.

Then there was nothing else I could do and it hit me: Marygay was dying. I felt hollow and helpless, clamped my jaws and swallowed against sudden nausea.

"Mandella!" Struve had been talking to me.

"Yes?"

"I said, anything else you can do?"

"No." I stirred my finger through the ointments and ampoules in the kit. "Can you think of anything?"

"I'm no more of a medic than you are." Looking up at the door, he kneaded a fist, biceps straining. "Where the hell are they? You have morph-plex in that kit?"

"Yeah. You don't use it when you have internal—"

"There!" Doc Wilson crowded through the door, followed by two medics with a stretcher. They worked fast, saying nothing to us or to each other. One medic verified Marygay's blood type, rubbing the blood off the tattoo on her hip. He nodded to the other, who ran a needle into her thigh and started giving whole blood from a plastic bag.

Doc Wilson pulled on a pair of transparent gloves and gently lifted the soaked bandage off, dropped it to the floor, inspected the wound

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while he unrolled a new bandage. It was the same length as mine had been. He unrolled another and overlapped them, then fixed them in place with transparent tape. He measured her temperature, pulse and blood pressure.

"Surgery A," he said to the medics. "I'll be up in a half-hour." He turned to Struve. "Anybody give her any medication?"

"No-shock," I said.

"O.K." He turned to go.

"Doc! Will she—"

"No time." He strode through the door.

"No *time*?" But he was gone.

"Haven't you heard, man?" One of the medics was fiddling with the stretcher, unfolding a vertical extension that would hold the blood-bag. "Don't you know the ship was hit?"

"Hit!" Then how could any of us be alive?"

"That's right. Four squad bays. Also the armor bay. At least we won't be landing on Aleph—not a fighting suit left on the ship, we can't fight in our—"

"What—which squad bays, what happened to the people?"

"No survivors."

Thirty people. "Who was it?"

"All of the third platoon. First squad of the second."

Al-Sadat, Busia, Maxwell, Negulesco. "My God."

"Thirty-one deaders and they don't have the slightest idea of what caused it. Don't know but what it might happen again any minute." He looked up at the other medic. "Ready?"

"Yeah." He had removed all of the support tubes while we were talking. He held the blood-bag in his teeth to keep it higher than Marygay and the two of them lifted her slowly out of the pod.

"It wasn't a drone, they say we got all of the drones. Got the enemy vessel, too. Nothing on the sensors, just *blam!* and a third of the ship torn to hell. Lucky it wasn't the drive or the life-support system."

I was hardly hearing him. Penworth, LaBatt, Smithers. Christine and Frida. All dead. Marygay dying, that was even worse. I was numb.

"Let's go." They carried her out and I started to follow. In the corridor they told me to stay, it was too crowded upstairs.

I felt suddenly weak and sat down in the corridor. Sat for a long time with my head between my knees, trying not to think, shutting everything out, trying to relax myself back into shape.

The squawk-box crackled. "All personnel. Attention, all personnel echelon six and above. Report immediately to the assembly area unless you are directly involved in medical or maintenance emergencies."

After it had repeated the order three times I stood up and headed in that general direction.

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V

Halfway to the assembly area I realized what a mess I was, and ducked into the head by the NCO lounge. Corporal Kamehameha was hurriedly brushing her hair.

"William! What happened to you?"

"Nothing." I turned on a tap and looked at myself in the mirror. Dried blood smeared all over my face and tunic. "It was Marygay—Corporal Potter—her suit . . . well, evidently it got a crease, uh . . ."

"Dead?"

"No, just badly, uh, she's going into surgery—"

"Don't use hot water. You'll just set the stain."

"Oh. Right." I used the hot to wash my face and hands; dabbed at the tunic with cold. "Your squad's just two bays down from Al's, isn't it?"

"Yes."

"Did you see what happened?"

"No. Yes. Not *when* it happened." For the first time I noticed that she was crying, big tears rolling down her cheeks and off her chin. Her voice was even, controlled. She pulled at her hair savagely. "It's a mess."

I stepped over and put my hand on her shoulder. "*Don't touch me!*" she flared and knocked my hand off with the brush. "Sorry. Let's go."

At the door to the head she touched me lightly on the arm. "William . . ." She looked at me defiantly. "I'm just glad it wasn't me. You understand? That's the only way you can look at it."

I understood but I didn't know that I believed her.

"I can sum it up very briefly," the commodore said in a tight voice, "if only because we know so little.

"Some ten seconds after we destroyed the enemy vessel, two objects, very small objects, struck the *Anniversary* amidships. By inference, since they were not detected and we know the limits of our detection apparatus, we know that they were moving in excess of nine-tenths the speed of light. That is to say, more precisely, their velocity vector *normal* to the axis of the *Anniversary* was greater than nine-tenths the speed of light. They slipped in behind the repeller fields."

When the *Anniversary* is moving at relativistic speeds, it is designed to generate two powerful electromagnetic fields, one centered about five thousand kilometers from the ship and the other about ten thousand klicks away, both in line with the direction of motion of the ship. These fields are maintained by a "ramjet" effect; energy picked up from interstellar gas as we mosey along.

Anything big enough to worry about hitting (that is, anything big enough to see with a strong mag-

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(just a glass) goes through the first field and comes out with a very strong negative charge all over its surface. As it enters the second field it is repelled from the path of the ship. If the object is too big to be pushed around this way, we can sense it at a greater distance and maneuver out of its way.

"I shouldn't have to emphasize how formidable a weapon this is. When the *Intrepid* was struck, our rate of speed with respect to the enemy was such that we traveled at a wavelength every ten-thousandth of a second. Further, we were jerking around erratically as the ship constantly changing and purely random lateral acceleration. Thus the object that struck us must have been guided, not aimed, and the guidance system was self-contained since there were no Taurans aboard at the time they struck us. All of this in a package no larger than a small pebble.

"Most of you are too young to remember the term, *future shock*, back in the Seventies, some people felt that technological progress was accelerating that people, normal people, just couldn't cope with it, that they wouldn't have time to get used to the present, before the future was upon them. A man named Toffler coined the term, *future shock*, to describe this situation." The commodore could get pretty academic.

"We're caught up in a physical situation that resembles this scholarly concept. The result has been disaster. Tragedy. And, as we discussed in our last meeting, there is no way to counter it. Relativity traps us in the enemy's past; relativity brings them from our future. We can only hope that next time, the situation will be reversed. And all we can do to help bring that about is try to get back to Stargate, and then to Earth, where specialists may be able to deduce something, some sort of counterweapon, from the nature of the damage.

"Now we could attack the Taurans' portal planet from space, and perhaps destroy the base without using you infantry. But I think there would be a very great risk involved. We might be . . . shot down by whatever hit us today. And never return to Stargate with what I consider to be vital information. We could send a drone with a message detailing our assumptions about this new enemy weapon . . . but that might be inadequate. And the Force would be that much further behind, technologically.

"Accordingly, we have set a course that will take us around Yod-Four, keeping the collapsar as much as possible between us and the Tauran base. We will avoid contact with the enemy and return to Stargate as quickly as possible."

Incredibly, the commodore sat down and kneaded his temples. "All of you are at least squad or section leaders. Most of you have good combat records. And I hope

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that some of you will be rejoining the Force after your two years are up. Those of you who do will probably be made lieutenants, and face your first real command.

"It is to these people I would like to speak for a few moments; not as your . . . as one of your commanders, but just as a senior officer and adviser.

"One cannot make command decisions simply by assessing the tactical situation and going ahead with whatever course of action will do the most harm to the enemy with a minimum of death and damage to your own men and materiel. Modern warfare has become very complex, expecially during the last century. Wars are not won by a simple series of battles won, but by a complex interrelationship between military victory, economic pressures, logistic maneuvering, access to the enemy's information, political postures—dozens, literally dozens of factors."

I was hearing this but the only thing that was getting through to my brain was that a third of our friends' lives had been snuffed out less than an hour before, and the woman I loved was dying upstairs, and he was sitting up there giving us a lecture on military theory.

"So sometimes you have to throw away a battle in order to help win the war. This is exactly what we are going to do.

"This was not an easy decision. In fact, it was probably the hardest decision of my military career. Because, on the surface at least, it may look like cowardice.

"The logistic computer calculates that we have about a sixty-two percent chance of success, should we attempt to destroy the enemy base. Unfortunately, we would only have a thirty percent chance of survival—as some of the scenarios leading to success involve ramming the portal planet with the *Anniversary* at light-speed." Jesus Christ.

"I hope none of you ever have to face such a decision. When we get back to Stargate I will in all probability be court-martialed for cowardice under fire. But I honestly believe that the information that may be gained from analysis of the damage to the *Anniversary* is more important than the destruction of this one Tauran base." He sat up straight. "More important than one soldier's career."

I had to stifle an impulse to laugh. Surely "cowardice" had nothing to do with his decision. Surely he had nothing so primitive and unmilitary as a will to live.

The maintenance crew managed to patch up the huge rip in the side of the *Anniversary* and repressurize that section. We spent the rest of the day cleaning up the area; without, of course, disturbing any of the precious evidence for which the commodore was willing to sacrifice his career.

The hardest part was jettisoning

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the bodies. It wasn't so bad except for the ones whose suits had burst.

Marygay came out of the operation alive but in pretty bad shape. Her intestine had ruptured under pressure and she'd developed peritonitis. Under these conditions, Doc Wilson said, her condition was very grave; he could keep her alive indefinitely in normal gravity or less, but he didn't know whether she would survive the period of acceleration before collapsar jump.

The week that followed was slow hell. I screwed up the most routine chores and snapped at everybody and couldn't sleep for worry and gathering grief. Marygay's condition got no better, no worse. I was allowed to see her a few times but she was so doped up I think she hardly recognized me.

Two days before collapsar jump, I was supervising routine maintenance on the pods and an idea that had been forming all along suddenly crystallized. I put Tate in charge and ran up to the infirmary. The nurse on duty calmed me down with a cup of soya and I had an hour to think over the plan while Doc Wilson worked on somebody's arm. Finally I got to see him.

"We're giving her a fifty-fifty chance, but that's pretty arbitrary. None of the published data on this sort of thing really fit."

He drew a cup of soya and sat down, sighing. "So you've got an idea."

"Well . . . look, Doctor, I don't know much about medicine, but I *do* know physics. Now, isn't it safe to say that her chances are better, the less acceleration she has to endure?"

"Certainly. For what it's worth. The commodore's going to take it as gently as possible, but that'll still be four or five G's. Even three might be too much; we won't know until it's over."

I nodded impatiently. "Yes, but I think there's a way to expose her to less acceleration than the rest of us."

"If you've developed an acceleration shield," he said, smiling, " you better hurry and file a patent. You could sell it to Star Fleet for a considerable—"

"No, Doc, it wouldn't be worth much under normal conditions; our shells work better and they evolved from the same principles."

"Explain away."

"We put Marygay into a shell and flood—"

"Wait, wait. Absolutely not. A poorly-fitting shell was what caused this in the first place. And this time, she'd have to use somebody else's."

"I know, Doc, let me explain. It doesn't have to fit her exactly, just so long as the life support hookups can function. The shell won't be pressurized on the inside; it won't have to be because she won't be

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subjected to all those thousands of kilograms per square centimeter pressure from the fluid outside."

"I'm not sure I follow."

"It's just an adaptation of—you've studied physics, haven't you?"

"A little bit, in medical school. My worst courses, after Latin."

"Do you remember the principle of equivalence?"

"I remember there was something by that name. Something to do with relativity, right?"

"Uh-huh. It just means that . . . there's no difference being in a gravitational field and being in an equivalent accelerated frame of—it means that when the *Anniversary* is blasting five G's, the effect on us is the same as if it were sitting on its tail on a big planet, one with five G's surface gravity."

"Seems obvious."

"Maybe it is. It means that there's no experiment you could perform on the ship that could tell you whether you were blasting or just sitting on a big planet."

"Sure there is. You could turn off the engines, and if—"

"Or you could look outside, sure; I mean isolated, physics-lab type experiments."

"All right. I'll accept that. So?"

"You know Archimedes' Law?"

"Sure, the fake crown—that's what always got me about physics, they make a big to-do about obvious things and when it gets to the rough parts—"

"Archimedes' Law says that when you immerse something in a fluid, it's buoyed up by a force equal to the weight of the fluid it displaces."

"That's reasonable."

"And that holds no matter what kind of gravitation or acceleration you're in—in a ship blasting at five G's, the water displaced, if it's water, weighs five times as much as regular water, at one G."

"Sure."

"So if you float somebody in the middle of a tank of water, so that she's weightless, she'll still be weightless when the ship is doing five G's."

"Hold on, son. You had me going there for a minute, but it won't work."

"Why not?" I was tempted to tell him to stick to his pills and stethoscopes and let me handle the physics, but it was a good thing I didn't.

"What happens when you drop a wrench in a submarine?"

"Submarine?"

"That's right. They work by Archimedes' principle—"

"Ouch! You're right." Jesus. Hadn't thought it through.

"That wrench falls right to the floor just as if the submarine weren't 'weightless'." He looked off into space, tapping a pencil on the desk. "What you describe is similar to the way we treat patients with severe skin damage, like burns, on Earth. But it doesn't give any sup-

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port to the internal organs, the way the acceleration shells do, so it wouldn't do Marygay any good . . ."

I stood up to go. "Sorry I wasted . . ."

"Hold on there, though, just a minute. We might be able to use your idea part-way."

"How do you mean?"

"I wasn't thinking it through, either. The way we normally use the shells is out of the question for Marygay, of course." I didn't like to think about it. Takes a lot of hypno-conditioning to lie there and have oxygenated fluorocarbon forced into every natural body orifice and one artificial one. I fingered the valve fitting embedded above my hipbone.

"Yeah, that's obvious, it'd tear her sa . . . you mean, low pressure . . ."

"That's right. We wouldn't need thousands of atmospheres to protect her against five G's straight-line acceleration; that's only for all the swerving and dodging—I'm going to call Maintenance. Get down to your squad bay, that's the one we'll use. Dalton'll meet you there."

It was five minutes before injection into the collapsar field and I started the flooding sequence. Marygay and I were the only ones in shells; my presence wasn't really vital since the flooding and emptying could be done by Control. But it was safer to have redundancy in the system and besides, I wanted to be there.

It wasn't nearly as bad as the normal routine; none of the crushing-bloating sensation. You were just suddenly filled with the plastic-smelling stuff (you never perceived the first moments, when it rushed in to replace the air in your lungs), and then there was a slight acceleration, and then you were breathing air again, waiting for the shell to pop; then unplugging and unzipping and climbing out—

Marygay's shell was empty. I walked over to it and saw blood.

"She hemorrhaged." Doc Wilson's voice echoed sepulchrally. I turned, eyes stinging, and saw him leaning in the door to the locker alcove. He was unaccountably horribly smiling.

"Which was expected. Doctor Harmony's taking care of it. She'll be just fine."

VI

Marygay was walking in another week, "confraternizing" in two, and pronounced completely healed in six.

Ten long months in space and it was Army, Army, Army all the way. Calisthenics, meaningless work details, compulsory lectures—there was even talk that they were going to reinstate the sleeping roster we'd had in Basic, but they never did, probably out of fear of

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mutiny. A random partner every night wouldn't have set too well with those of us who'd established more-or-less permanent pairs.

All this crap, this insistence on military discipline, mainly bothered me because I was afraid it meant they weren't going to let us out. Marygay said I was being paranoid; they only did it because there was no other way to maintain order for ten months.

Most of the talk, besides the usual bitching about the Army, was speculation about how much Earth would have changed, and what we were going to do once we got out. We'd be fairly rich: twenty-six years' salary all at once. Compound interest, too; the five hundred dollars we'd been paid for our first month in the Army had grown to over fifteen hundred dollars.

We arrived at Stargate in early 2023, Greenwich date.

The base had grown astonishingly in the nearly seventeen years we had been on the Yod-Four campaign. It was one building the size of Tycho City, housing nearly ten thousand. There were seventy-eight cruisers, the size of the *Anniversary* or larger, involved in raids on Tauran-held portal planets. Another ten guarded Stargate itself, and two were in orbit waiting for their infantry and crew to be outprocessed. One other ship, the *Earth's Hope II,* had returned from fighting and had been waiting at Stargate for another cruiser.

They had lost two-thirds of their men and it was just not economical to send a cruiser back to Earth with only thirty-nine people aboard. Thirty-nine confirmed civilians.

We went planetside in two scoutships.

General Botsford (who had only been a major when we'd first met him, when Stargate was two huts and twenty-four graves) received us in an elegantly-appointed seminar room. He was pacing back and forth at the end of the room, in front of a huge holographic operations cube. I could just make out the labels and was astonished to see how far away Yod-Four had been—but of course distance isn't important with the collapsar jump. It'd take us ten times as long to get to Alpha Centauri, which was practically next door but, of course, isn't a collapsar.

"You know—" he said, too loudly, and then more conversationally, "you know that we could disperse you into other strike forces and send you right out again. The Elite Conscription Act has been changed now, extended, five years' subjective service instead of two.

"We aren't doing that, but—damn it!—I don't see why some of you don't *want* to stay in! Another couple of years and compound interest would make you wealthy for life. Sure, you took heavy losses

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but that was inevitable; you were the first. Things are going to be easier now. The fighting suits have been improved, we know more about Taurans' tactics, our weapons are more effective . . . there's no need to be afraid."

He sat down at the head of our table and looked down the long axis of it, seeing nobody. "My own memories of combat are over a half-century old. To me it was exhilarating, strengthening. I must be a different kind of person from all of you."

Or have a very selective memory, I thought.

"But that's neither here nor there. I have an alternative to offer you, one that doesn't involve direct combat.

"We're very short of qualified instructors. You might even say we don't *have* any because, ideally, the Army would like for all of its instructors in the combat arts to have been combat veterans.

"You people were taught by veterans of Vietnam and Sinai, the youngest of whom were in their forties when you left Earth, twenty-six years ago. So we need you and are willing to pay.

"UN Force will offer any one of you a lieutenancy if you will accept a training position. It can be on Earth, on the Moon at double pay; on Gibson at triple pay; or here at Starside for quadruple pay. Furthermore, you don't have to make up your mind now. You're all getting a free trip back to Earth—I envy you, I haven't been back in twenty years, will probably never get back—and you can get the feel of being a civilian again. If you don't like it, just walk into any UNEF installation and you'll walk out an officer. Your choice of assignment.

"Some of you are smiling. I think you ought to reserve judgment. Earth is not the same place you left."

He pulled a little card out of his tunic and looked at it, half-smiling. "Most of you have on the order of four hundred thousand dollars coming to you, accumulated pay and interest. But Earth is on a war footing and, of course, it is the citizens of Earth who are supporting the war with their tax dollars. Your income puts you in a ninety-two percent income tax bracket. Thirty-two thousand dollars could last you about three years if you're very careful.

"Eventually you're going to have to get a job, and this is one job for which you are uniquely trained. There aren't that many others available—the population of Earth is over nine billion, with five or six billion unemployed. And all of your training is twenty-six years out of date.

"Also keep in mind that your friends and sweethearts of two years ago are now going to be twenty-six years older than you. Many of your relatives will have

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passed away. I think you'll find it a very lonely world.

"But to tell you more about this world, I'm going to turn you over to Sergeant Siri, who just arrived from Earth. Sergeant?"

"Thank you, General." It looked as if there was something wrong with his skin, his face: and then I realized he was wearing face powder and lipstick. His nails were smooth white almonds.

"I don't know where to begin." He sucked in his upper lip and looked at us, frowning. "Things have changed so very much since I was a boy.

"I'm twenty-three, so I wasn't even born when you people left for Aleph . . . well, for starts, how many of you are homosexual?" Nobody. "That doesn't really surprise me. I am, though"—no kidding—"and I guess about a third of everybody in Europe and North America is. Even more in India and the Middle East. Less in South America and China.

"Most governments encourage homosexuality—the United Nations is officially neutral—they encourage it mainly because homolife is the one sure method of birth control."

That sounded specious to me. In the Army they freeze-dry and file a sperm sample and then vasectomize you. Pretty foolproof.

When I was going to school, a lot of the homosexuals on campus were using that argument. And maybe it was working, after a fashion. I'd expected Earth to have a lot more than nine billion people.

"When they told me, back on Earth, I was going to be talking to some of you codgers, I did some research—mainly reading old faxes and magazines.

"A lot of the things you were afraid were going to happen, didn't. Hunger, for instance. Even without using all of our arable land and sea, we manage to feed everybody and could handle twice as many. Food technology and impartial distribution of calories—when you left Earth there were millions of people slowly starving to death. Now there are none.

"You were concerned about crime. I read that you couldn't walk the streets of New York City or London or Hong Kong without a bodyguard. But with everybody better educated and better cared for, with psychometry so advanced that we can spot a potential criminal at the age of six—and give him corrective therapy that works—well, serious crime has been on the decline for twenty years. We probably have fewer serious crimes in the whole world than you used to have—"

"This is all well and good," the general broke in gruffly, making clear that it was neither, "but it doesn't completely mesh with what I've heard. What do you call a serious crime? What about the rest?"

"Oh, murder, assault, rape; all the serious crimes against one's

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person all are down. Crimes against property petty theft, vandalism, illegal residence these are still—"

"What the hell is 'illegal residence'?"

Sergeant Siri hesitated and then said primly, "One certainly shouldn't deprive others of living space by illegally acquiring property."

Alexandrov raised his hand. "You mean there's no such thing as private ownership of property?"

"Of course there is. I . . . I owned my own rooms before I was drafted." For some reason the topic seemed to embarrass him. New taboos? "But there are limits."

Lathuli: "What do you do to criminals? Serious ones, I mean. Do you still brainwipe murderers?"

He was visibly relieved to change the subject. "Oh, no. That's considered very primitive. Barbaric. We imprint a new healthy personality on them, then they are repatterned and society absorbs them without prejudice. It works very well."

"Are there jails, prisons?" Yukawa asked.

"I suppose you could call a correction center a jail. Until they have therapy and are released, people are held there against their will. But you could say it was a malfunction of the will which led them there in the first place."

I didn't have any plans for a life of crime, so I asked him about the thing that bothered me most. "The general said that over half your population is on the dole; that we wouldn't be able to get jobs either. Well?"

"I don't know this word 'dole'. Of course you mean the government-subsidized unemployed. That's true, the government takes care of over half of us—I'd never had a job until I was drafted. I was a composer.

"Don't you see that there are two sides to this business of chronic unemployment? The world and the war could be run smoothly by a billion, certainly two billion people. This doesn't mean that the rest of us sit around idle.

"Every citizen has the opportunity for up to eighteen years' free education—fourteen years are compulsory. This and the *freedom* from necessity of employment have caused a burgeoning of scholarly and creative activity on a scale unmatched in all of human history—there are more artists and writers working today than lived in the first two thousand years of the Christian era! And their works go to a wider and more educated audience than has ever before existed."

That was something to think about. Rabi raised his hand. "Have you produced a Shakespeare yet? A Michelangelo? Numbers aren't everything."

Siri brushed hair out of his eyes with a thoroughly feminine gesture. "That's not a fair question. It's up

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to posterity to make comparisons like that."

"Sergeant, when we were talking earlier," the general said, "didn't you say that you lived in a huge beehive of a building, that nobody could live in the country?"

"Well, sir, it's true that nobody can live on potential farm land. And where I live, *lived,* Atlanta Complex, I had seven million neighbors in what you could technically call one building—but it's not as if we ever felt crowded. And you can go down the elevator any time, walk in the fields, walk all the way to the sea if you want . . .

"That's something you should be prepared for. A lot of cities don't bear any resemblance to the random agglomerations of buildings they used to be. Most of the big cities were burned to the ground in the food riots in 2004, just before the United Nations took over the production and distribution of food. The city planners usually rebuilt along modern, functional lines.

"Paris and London, for instance, had to be rebuilt completely. Most world capitals did, though Washington survived. It's just a bunch of monuments and offices, though; almost everybody lives in the surrounding complexes: Reston, Frederick, Columbia."

Then Siri got into specific towns and cities—everybody wanted to know about his home town—and, in general, things sounded a lot better than we had expected.

In response to a rude question, Siri said that he didn't wear cosmetics just because he was a homosexual; everybody did. I decided I'd be a maverick and just wear my face.

We consolidated with the survivors from *Earth's Hope II* and took that cruiser back to Earth while analysts assessed the *Anniversary*'s damage. The commodore was scheduled for a hearing, but, as far as we knew, was not going to be court-martialed.

Discipline was fairly relaxed on the way back. In seven months I read thirty books, learned how to play *Go,* taught an informal class in elementary physics, and grew ever closer to Marygay.

VII

I hadn't given it much thought, but of course we were celebrities on Earth. At Kennedy the Sec-Gen greeted each of us personally—he was a very old, tiny, black man named Yakubu Ojukwu—and there were hundreds of thousands, maybe millions of spectators crowded as close as they could get to the landing field.

The Sec-Gen gave a speech to the crowd and the newsmen, then the ranking officers of *Earth's Hope II* babbled some predictable stuff while the rest of us stood more-or-less patiently in the tropical heat.

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We took a big chopper to Jacksonville, where the nearest international airport was. The city itself had been rebuilt along the lines Siri had described. You had to be impressed.

We first saw it as a solitary gray mountain, a slightly irregular cone, slipping up over the horizon and growing slowly larger. It was sitting in the middle of a seemingly endless patchwork quilt of cultivated fields, dozens of roads and rails converging on it. The eye saw these roads, fine white threads with infinitesimal bugs crawling on them, but the brain refused to integrate the information into an estimate of the size of the thing. It couldn't be that big.

We came closer and closer—updrafts making the ride a little bumpy—until finally the building seemed to be just a light gray wall taking up our entire field of vision on one side. We moved closer and could barely see dots of people; one dot was on a balcony and might have been waving.

"This is as close as we can come," the pilot said over an intercom, "without locking into the city's guidance system and landing on top. Airport's to the north." We banked away, through the shadow of the city.

The airport was no great marvel; larger than any I'd ever seen before but conventional in design: a central terminal like the hub of a wheel with monorails leading out a kilometer or so to smaller terminals where airplanes loaded and unloaded. We skipped the terminals completely, just landed near a Swissair stratospheric liner and walked from the chopper to the plane. Our pathway was cordoned off and we were surrounded by a cheering mob. With six billion on relief, I didn't suppose they had any trouble rounding up a crowd for any such occasion.

I was afraid we were going to have to sit through some more speeches, but we just filed straight into the plane. Stewards and stewardesses brought us sandwiches and drinks while the crowd was being dispersed. And there are no words to describe a chicken-salad sandwich and a cold beer, after two years of synthetics.

Mr. Ojukwu explained that we were going to Geneva, to the United Nations building, where tonight we'd be honored by the General Assembly. Or put on display, I thought. He said most of us had relatives waiting in Geneva.

As we climbed over the Atlantic, the water seemed unnaturally green. I was curious, made a mental note to ask the stewardess; but then the reason was apparent. It was a farm. Four large rafts (they must have been huge but I had no idea how high up we were) moved in slow tandem across the green surface, each raft leaving a blue-black swath that slowly faded. Before we landed I found out that it

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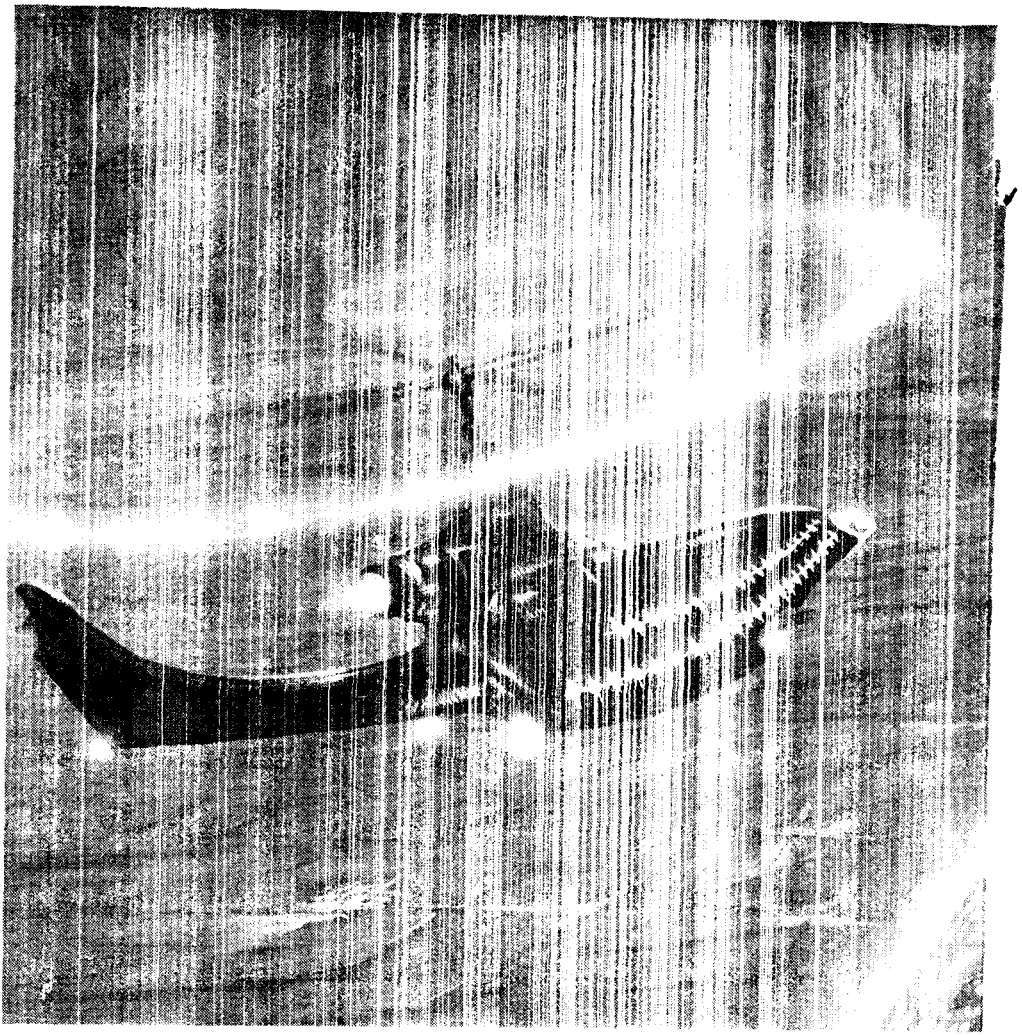

was a kind of tropical algae, raised for livestock feed.

Geneva was a single building similar to Jacksonville, but seemed smaller, perhaps dwarfed by the natural mountains surrounding it. It was covered with snow, softly beautiful.

We walked for a minute through swirling snow. How great not to be exactly at "room temperature" all the time! To a chopper that took us to the top of the building; then down an elevator, across a slidewalk, down another elevator, another slidewalk, down a broad sta-

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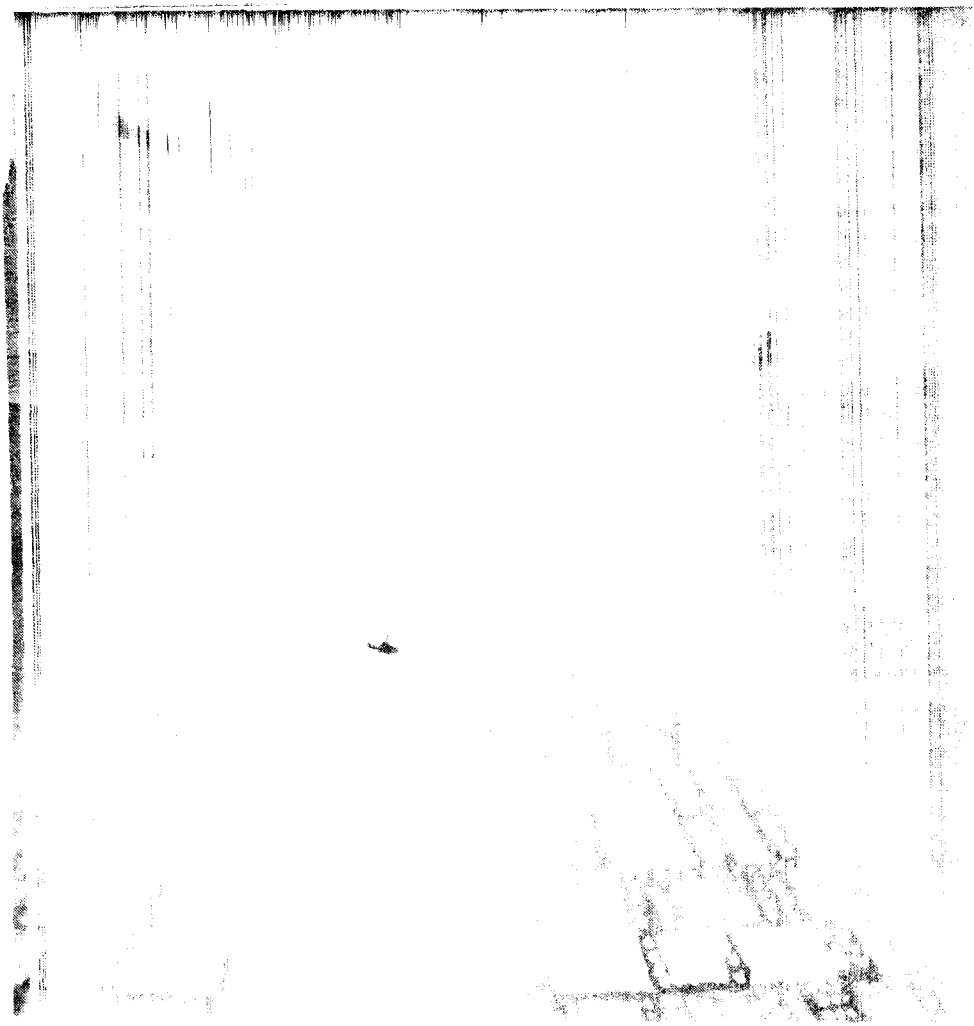

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me as much as the
prospect of seeing my mother, sud-
denly eighty-four, I almost ducked
out to find a bar and desensitize,
but went ahead and pushed the
button.

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The door opened quickly and she was older but not that much different, a few more lines and hair white instead of gray. We stared at each other for a second and then embraced and I was surprised and relieved at how happy I was to see her, hold her.

She took my cape and hustled me into the living room of the suite, where I got a real shock: my father was standing there; smiling but serious, inevitable pipe in his hand.

I felt a flash of anger at the Army for having misled me—then realized he couldn't be my father, looking as he did, the way I remembered him from childhood.

"Michael? Mike?"

He laughed. "Who else, Willy?" My kid brother, quite middle-aged. I hadn't seen him since '93, when I went off to college. He'd been sixteen then; two years later he was on the Moon with UNEF.

"Get tired of the Moon?" I asked, handshaking.

"Huh? Oh . . . no, Willy, I spend a month or two every year, back on *terra firma.* It's not like it used to be." When they were first recruiting for the Moon, it was with the understanding that you only got one trip back. Fuel cost too much for commuting.

The three of us sat down around a marble coffee table and Mother passed around joints.

"Everything has changed so much," I said, before they could start asking about the war. "Tell me everything."

My brother fluttered his hands and laughed. "That's a tall enough order. Have a couple of weeks?" He was obviously having trouble figuring out how to act toward me. Was I his nephew, or what? Certainly not his older brother any more.

"You shouldn't ask Michael, anyhow," Mother said. "Loonies talk about Earth the way virgins talk about sex."

"Now, Mother . . ."

"With enthusiasm and ignorance."

I lit up the joint and inhaled deeply. It was oddly sweet.

"Loonies live a few weeks out of the year on Earth and spend half that time telling us how we ought to be running things."

"Possibly. But the other half of the time we're observing. Objectively."

"Here comes my Michael's 'objective' number." She leaned back and smiled at him.

"Mom, you *know* . . . oh hell, let's drop it. Willy's got the rest of his life to sort it out." He took a puff on the joint and I noticed he wasn't inhaling. "Tell us about the war, man. Heard you were on the strike force that actually fought the Taurans. Face to face."

"Yeah. It wasn't much."

"That's right," Mike said. "I heard they were cowards."

"Not so much . . . that." I shook

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my head to clear it. The marijuana was making me drowsy and lightheaded. "It was more like they just didn't get the idea. Like a shooting gallery. They lined up and we shot 'em down."

"How could that be?" Mom said. "On the news they said you lost nineteen people."

"Did they say nineteen were killed? That's not true."

"I don't remember exactly."

"Well, we did *lose* nineteen people, but only four of them were killed. That was in the early part of the battle, before we had their defenses figured out." I decided not to say anything about the way Chu died. That would get too complicated. "Of the other fifteen, one was shot by one of our own lasers. He lost an arm but lived. All of the others lost their minds."

"What some kind of Tauran weapon?" Mike asked.

"The Taurans didn't have anything to do with it! It was the Army. They conditioned us to kill anything that *moved*, once the sergeant triggered the conditioning with a few key words. When people came out of it, they couldn't handle the memory. Being a butcher." I shook my head violently a couple of times. The dope was really getting to me.

"Look. I'm sorry." I got to my feet with some effort. "I've been up some twenty—"

"Of course, William." Mother took my elbow and steered me to a bedroom and promised to wake me in plenty of time for the evening's festivities. The bed was indecently comfortable but I could've slept leaning up against a lumpy tree.

Fatigue and dope and too full a day: Mother had to wake me up by trickling cold water on my face. She steered me to a closet and identified two outfits as being formal enough for the occasion. I chose a brick-red one—the powder blue seeming a little foppish—showered and shaved, refused cosmetics (Mike was all dolled up and offered to help me), armed myself with the half-page of instructions telling how to get to the General Assembly, and was off.

I got lost twice along the way, but they have these little computers at every corridor intersection that will give you directions to anyplace, in fourteen languages.

Men's clothing, as far as I was concerned, had really taken a step backward. From the waist up it wasn't so bad, tight high-necked blouse with a short cape; but then there was a wide shiny functionless belt, from which dangled a little jeweled dagger, perhaps adequate for opening mail; and then pantaloons that flounced out in great pleats and were tucked into shiny synthetic high-heeled boots that came almost to your knees. Give me a plumed hat and Shakespeare would've hired me on the spot.

The women fared better. I met

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Marygay outside the General Assembly hall.

"I feel absolutely naked, William."

"Looks good, though. Anyhow, it's the style." Most of the young women I'd passed had been wearing a similar outfit: a simple shift with large rectangular windows cut in both sides, from armpit to hem. The hem ended where your imagination began. For modesty, the outfit required very conservative movements and a great faith in static electricity.

"Have you seen this place?" she said, taking my arm. "Let's go on in, Conquistador."

We walked in through the automatic doors and I stopped short. The hall was so large that going into it, you felt as if you'd stepped outdoors.

The floor was circular, more than a hundred meters in diameter. The walls rose a good sixty or seventy meters to a transparent dome—I remembered having seen it when we landed—on which gray drifts of snow danced and blew swirling away. The walls were done in a muted ceramic mosaic, thousands of figures representing a chronology of human achievement. I don't know how long I stared.

Across the hall, we joined the other hardy veterans for coffee. It was synthetic, but better than soya. To my dismay, I learned that tobacco was rarely grown on Earth and even, through local option, was outlawed in some areas in order to conserve arable land. What you could get was expensive and usually wretched, having been grown by amateurs on tiny backyard or balcony plots. The only good tobacco was Lunar and its price was, well, astronomical.

Marijuana was plentiful and cheap. In some countries, like the United States, it was free; produced and distributed by the government.

I offered Marygay a joint and she declined. "I've got to get used to them slowly. I had one earlier and it almost knocked me out."

"Me too."

An old man in uniform walked into the lounge, his breast a riotous fruit salad of ribbons, his shoulders weighed down with five stars apiece. He smiled benignly when half the people jumped to their feet. I was too much a civilian already, and remained seated.

"Good evening, good evening," he said, making a patting sit-down motion with his hand. "It's good to see you here. Good to see so many of you." Many? A little more than half the number we started out with.

"I'm General Gary Manker, UNEF Chief of Staff. In a few minutes we're going over there," he nodded in the direction of the General Assembly hall, "for a short ceremony. Then you'll be free for a well-deserved rest; put your feet up for a few months, see the world,

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whatever you want. So long as you can keep the reporters away.

Before you go over, though, I'd like to say a few words about what you'll want to do *after* those reporters when you get tired of being a celebrity, when the money starts to run low . . ." Predictably, he said, cried General Bolsford had got us at Stargate. You're going to need a job, and this is the best job you can be sure of getting.

The general left after saying that the rest would be by in a few minutes. We moved closer to the rostrum. We amused ourselves for several minutes discussing the merits of the replacement.

The aide turned out to be a good-looking young woman who had no trouble rallying us into an orderly order—she didn't seem to have any higher opinion of the reporters than did we—and leading us to the bus.

The bus was full of rows of delegates who abandoned their desks to sit next to the "Gambia" place and listen uncomfortably to tales of heroism and sacrifice. General Mankey had most of the facts right but used slightly wrong words.

Then we filed us up one by one and Dr. Ojukwu gave each of us a gold medal that must have weighed a kilogram. Then he gave a terrific speech about mankind united in a common cause while dignitaries scanned us one more inspiring face for the folks back home. Then we filed out under waves of applause that were somehow oppressive.

I had asked Marygay, who had no living relatives, to come on up and sack with me. There was a crowd milling around the formal entrance to the hall, so we hustled the other way, took the first escalator up several stories and got totally lost on a succession of slidewalks and lifts. Then we used the little corner boxes to find our way home.

I'd told Mother about Marygay and that I'd probably be bringing her back. They greeted each other warmly and Mother settled us in the living room with a couple of drinks and went off to start dinner. Mike joined us.

"You're going to find Earth awfully boring," he said after amenities.

"I don't know," I said. "Army life isn't exactly stimulating. Any change has got to be—"

"You can't get a job."

"Not in physics, I know; twenty-six years is like a geologic—"

"You can't get *any* job."

"Well, I'd planned to go back and take my Master's degree over, maybe go on . . ." Mike was shaking his head.

"Let him finish, William." Marygay shifted restlessly. "I think he knows something we don't."

He finished his drink and swirled the ice around in the bottom of the glass, staring at it. "That's right. You know, the Moon is all UNEF,

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civilians and military, and we amuse ourselves by passing rumors back and forth."

"Old military pastime."

"Uh-huh. Well, I heard a rumor about you . . ." he made a sweeping gesture, "you veterans and went to the trouble to check it out. It was true."

"Glad to hear it."

"Yeah, you will be." He set down his drink, took out a joint, looked at it, put it back. "UNEF is going to do anything short of kidnaping to get you people back. They control the Employment Board and you can be damned sure you're going to be undertrained or overtrained for any job opening that comes along. Except soldier."

"Are you sure?" Marygay asked. We both knew enough not to claim they couldn't do a thing like that.

"Sure as a Christian. I have a friend on the Luna division of the Employment Board. He showed me the directive; it's worded very politely. And it says 'absolutely no exceptions'."

"Maybe by the time I get out of school—"

"You'll never get *into* school. Never get past the maze of standards and quotas. If you try to push, they'll just claim you're too old—hell, I couldn't get into a doctoral program at *my* age, and you're—"

"Yeah, I get the idea. I'm two years older."

"That's it. You've got the choice of either spending the rest of your life on relief or soldiering."

"No contest," Marygay said. "Relief."

I agreed. "If five or six billion people can carve out a decent life without a profession, I can too."

"They've grown up in it," Mike said. "And it may not be what you would call a 'decent life'. Most of them just sit around and smoke dope and watch the holo. Get just enough to eat to balance their caloric output. Meat once a week. Even on Class I relief."

"That won't be anything new," I said. "The food part, anyhow—it's exactly the way we were fed in the Army.

"As for the rest of it, as you just said, Marygay and I didn't grow up in it; we're not likely to sit around half-blown and stare at the cube all day."

"I paint, " Marygay said. "I always wanted to settle down and get really good at it."

"And I can continue studying physics even if it's not for a degree. And take up music or writing or—" I turned to Marygay, "or any of those things the sergeant talked about at Stargate."

"Join the New Renaissance," he said without inflection, lighting his pipe. It was tobacco and smelled delicious.

He must have noticed my hunger. "Oh, I'm being a hell of a host." He got some papers out of

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his purse and rolled an expert joint. "Here, Marygay?"

"No thanks—if it's as hard to get as they say. I don't want to get back into the habit."

He nodded, relighting his pipe. "Never did anybody any good. Better to train your mind, be able to relax without it." He turned to me. "The Army *did* keep up your cancer boosters?"

"Sure. Wouldn't do for you to die in so unsoldierly a fashion. I lit up the slender cigarette. "Good stuff."

"Better than anything you'll get on Earth. Lunar marijuana is better, too. Doesn't mess you up so much."

Mother came in and sat down. "Dinner'll be ready in a few minutes. I hear Michael making unfair comparisons again."

"What's unfair? Earth marijuana, a couple of J's and you're a zombi."

"Correction, *you* are. You're just not used to it."

"O.K., O.K. And a boy shouldn't argue with his mother."

"Not when she's right," she said, strangely without humor. "Well! Do you children like fish?"

We talked about how hungry we were, a safe enough subject, for a few minutes and then sat down to a huge broiled red snapper served on a bed of rice. It was the first square meal Marygay and I had had in twenty-six years.

VIII

The next day, like everyone else, I went to get interviewed on the cube. It was a frustrating experience.

Commentator: "Sergeant Mandella, you are one of the most-decorated soldiers in the UNEF." True, all of us had gotten a fistful of ribbons at Stargate. "You participated in the famous Aleph-null campaign, the first actual contact with Taurans, and just returned from an assault on Yod-Four."

Me: "Well, you couldn't call it—"

Commentator: "Before we talk about Yod-Four, I'm sure the audience would be very interested in your *personal* impression of the enemy, as one of the very few people to have met them face-to-face. They're pretty horrible-looking, aren't they?"

Me: "Well, yes; I'm sure you've seen the pictures. About all they don't show you is the texture of the skin. It's pebbly and wrinkled like a lizard's, but pale orange."

Commentator: "What do they smell like?" Smell?

Me: "I haven't got the faintest idea. All you can smell in a spacesuit is yourself."

Commentator: "Ha-ha, I see. What I'm trying to get, Sergeant, is how *you* felt, the first time you saw the enemy . . . were you afraid of them, disgusted, enraged, or what?"

"Well, I *was* afraid, the first time, and disgusted. Mostly afraid—but

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that was before the battle, when a solitary Tauran flew overhead. During the actual battle, we were under the influence of hate-conditioning—they conditioned us on Earth and triggered it with a phrase—and I didn't feel much except the artificial rage."

"You despised them—and showed no mercy."

"Right. Murdered them all, even though they made no attempt to fight back. But when they released us from the conditioning . . . well, we couldn't believe we had been such butchers. Fourteen people went insane and all the rest of us were on tranquilizers for weeks."

"Ah," he said, absent-mindedly, and glanced over to the side for a moment. "How many of them did you kill, yourself?"

"Fifteen, twenty—I don't know; as I said, we weren't in control of ourselves. It was a massacre."

All through the interview, the commentator seemed a bit dense, repetitive. I found out why that night.

Marygay and I were watching the cube with Mike. Mom was off getting fitted with some artificial teeth (the dentists in Geneva supposedly being better than American ones). My interview was on a program called *Potpourri,* sandwiched between a documentary on Lunar hydroponics and a concert by a man who claimed to be able to play Telemann's *Double Fantasia in A Major* on the harmonica. I wondered whether anybody else in Geneva, in the world, was tuned in.

Well, the hydroponics thing was interesting and the harmonica player was a virtuoso, but the thing in between was pure drivel.

Commentator: "What do they smell like?"

Me (off-camera): "Just horrible, a combination of rotten vegetables and burning sulfur. The smell leaks in through the exhaust of your suit."

He had kept me talking and talking in order to get a wide spectrum of sounds, from which he could synthesize any kind of nonsense in response to his questions.

"How the hell can he do that?" I asked Mike when the show was over.

"Don't be too hard on him," Mike said, watching the quadruplicated musician play four different harmonicas against himself. "All the media are censored by the UNEF. It's been ten, twelve years since Earth had any objective reporting about the war. You're lucky they didn't just substitute an actor for you and feed him lines."

"Is it any better on Luna?"

"Not as far as public broadcast. But since every one there is tied into UNEF, it's easy enough to find out when they're lying outright."

"He cut out *completely* the part about conditioning."

"Understandable." Mike

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shrugged. "They need heroes, not automatons."

Marygay's interview was on an hour later, and they had done the same thing to her. Every time she had originally said something against the war or the Army, the cube would switch to a close-up of the woman interviewing her, who would nod sagely while a remarkable imitation of Marygay's voice gave out arrant nonsense.

UNEF was paying for five days' room and board in Geneva, and it seemed as good a place as any to begin exploring this new Earth. The next morning we got a map—which was a book a centimeter thick—and took a lift to the ground floor, determined to work our way up to the roof without missing anything.

The ground floor was an odd mixture of history and heavy industry. The base of the building covered a large part of what used to be the city of Geneva, and a lot of old buildings were preserved.

Mostly, though, it was all noise and hustle: big g-e trucks growling in from outside, shedding clouds of snow; barges booming against dock pilings (the Rhone River crawls through the middle of the huge expanse); even a few little helicopters beating this way and that, coordinating things, keeping away from the struts and buttresses that held up the gray sky of the next floor, forty meters up.

It was a marvel and more and we could have watched it for hours, but we would've frozen solid in a few minutes, with just light capes against the wind and cold. We decided we'd come back another day, more warmly dressed.

The floor above was called the first floor, in defiance of logic. Marygay explained that the Europeans had always numbered them that way (funny, I'd been a thousand light-years from New Mexico, and back, but this was the first time I'd crossed the Atlantic). It was the brains of the organism, where the bureaucrats and the systems analysts and the cryogenic handymen hung around.

We stood in a large quiet lobby that somehow smelled of glass. One wall was a huge holo cube displaying Geneva's table of organization, a spidery orange pyramid with tens of thousands of names connected by lines, from the mayor at top to the "corridor security" people at the base. Names flicked out and were replaced by new ones as people died or were fired or promoted or demoted. Shimmering, changing shape, it looked like the nervous system of some fantastic creature. In a sense, of course, it was.

The wall opposite the holo cube was a window overlooking a large room which a plaque identified as the *"Kontrollezimmer."* Behind the glass were hundreds of technicians in neat rows and col-

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umns, each with his own console with a semi-flat holo surrounded by dials and switches. There was an electric, busy air to the place: most of the people had on an earphone-microphone headset, talking with some other technician while they scribbled on a tablet or fiddled with switches; others rattled away on console keyboards with their headsets dangling from their necks. A very few seats were empty, their owners striding around looking important. An automated coffee tray slid slowly up one row and down the next.

Through the glass you could hear a faint susurrus of what must have been an unholy commotion inside.

There were only two other people in the lobby, and we overheard them say they were going to look at "the brain." We followed them down a long corridor to another viewing area, rather small in comparison to the one overlooking the control room, looking down on the computers that held Geneva together. The only illumination in the viewing area was the faint cold blue light from the room below.

The computer room was also small in comparison, about the size of a baseball diamond. The computer elements were featureless gray boxes of various sizes, connected by a maze of man-sized glass tunnels which had air locks at regular intervals. Evidently this system allowed access to one element at a time, for repair, while the rest of the room remained at a temperature near absolute zero, for superconductivity.

Though lacking the nervous activity of the control room, and far from the exciting hurly-burly on the floor below, the computer room was more impressive in its own static way: the feeling of vast, unknowable powers under constraint; a shrine to purpose, order, intelligence.

The other couple told us there was nothing else of interest on the floor, just meeting rooms and offices and busy officials. We got back on the lift and went to the second floor, which was the main shopping arcade.

Here, the map-book was very handy. The arcade was hundreds of shops and open-air markets arranged in a rectangular grid pattern, with interlacing slidewalks defining blocks where related shops were grouped together. We went to the central mall, which turned out to be a whimsical reconstruction of medieval village architecture. There was a Baroque church whose steeple, by holographic illusion, extended into the third and fourth floors. Smooth wall mosaics with primitive religious scenes, cobblestones laid out in intricate patterns, a fountain with water spraying from monsters' mouths . . . we bought a bunch of grapes from an open-air greengrocer (the illusion faltered when he took a calorie ticket and stamped my ration book)

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and walked along the narrow brick sidewalks, loving it. I was glad Earth still had time, and energy and resources, for this sort of thing.

There was a bewildering variety of objects and services for sale, and we had plenty of money, but we'd got out of the habit of buying things I guess, and we didn't know how long our fortunes were going to have to last.

(We *did* have small fortunes, in spite of what General Botsford had said. Rogers' father was some kind of hot-shot tax lawyer, and she'd passed the word—we only had to pay tax at the rate set for our *average* annual income. I wound up with $280,000.)

We skipped the third floor, mostly communications, because we'd crawled all over it the day before, when we went for our interviews. I was tempted to go speak to the person who'd rearranged my words, but Marygay convinced me it would be futile.

The artificial mountain of Geneva is "stepped" like a wedding cake: the first three floors and the ground "eye" about a kilometer in diameter, rising about a hundred meters; floors four through thirty-two the same height but about half the diameter; floors thirty-three through seventy-two make up the top cylinder, about three hundred meters in diameter by a hundred and twenty meters high.

The fourth floor, like the thirty-third, is all parks, trees, brooks, little animals. The walls are transparent, open in good weather, and the "shelf" (the roof of the third floor) is planted in heavy forest. We rested for a while by a pond, watching people swim and feeding bits of grape to the minnows.

Something had been bothering me subliminally ever since we arrived in Geneva and suddenly, surrounded by all these gay people, I knew what it was.

"Marygay," I said, "Nobody here is unhappy."

She smiled. "Who could be glum in a place like this? All the flowers and—"

"No, no . . . I mean in all of Geneva. Have you seen anybody who looked like he might be dissatisfied with the way things are? Who—"

"Your brother . . ."

"Yeah, but he's a foreigner too. I mean the merchants and workers and the people just hanging around."

She looked thoughtful. "I haven't really been looking. Maybe not."

"Doesn't that strike you as strange?"

"It is unusual . . . but . . ." She threw a whole grape in the water and the minnows scattered. "Remember what that homosexual sergeant said? They diagnose and correct antisocial traits at a very early age. And what rational person wouldn't be happy here?"

I snorted. "Half of these people are out of work and most of the

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others are doing artificial jobs that are either redundant or could be done better by machine."

"But they all have enough to eat and plenty to occupy their minds. That wasn't so, twenty-six years ago."

"Maybe," I said, not wanting to argue. "I suppose you're right." Still, it bothered me.

IX

We spent the rest of that day and all of the next in the United Nations headquarters, essentially the capital of the world, that took up the whole top cylinder of Geneva. It would have taken weeks to see everything. Hell, it would take more than a week just to cover the Family of Man Museum. And every country had its own individual display, with a shop selling typical crafts, sometimes a restaurant with native food. I had been afraid that national identities might have been submerged; that this new world would be long on order and short on variety. Glad to have been mistaken.

Marygay and I planned a travel itinerary while we toured the UN. We decided we'd go back to the United States and find a place to stay, then spend a couple of months traveling around.

When I approached Mom for advice in getting an apartment, she seemed strangely embarrassed, the way Sergeant Siri had been. But she said she'd see what was available in Washington (my father'd had a job there and Mom hadn't seen any reason to move after he died) when she got back, the next day.

I asked Mike about this reluctance to talk about housing and he said it was a hangover from the chaotic years between the food riots and the reconstruction. There just hadn't been enough roofs to go around; people had had to live two families to a room even in countries that had been prosperous. It had been an unstable situation and finally the UN stepped in, first with a propaganda campaign and finally with mass conditioning, reinforcing the idea that it was virtuous to live in as small a place as possible, that it was sinful to even *want* to live alone or in a place with lots of room. And one didn't talk about it.

Most people still had some remnant of this conditioning, even though they were detoxified over a decade before. In various strata of society it was impolite or unforgivable or rather daring, to talk about such things.

Mom went back to Washington and Mike to Luna while Marygay and I stayed on at Geneva for a couple of days.

We got off the plane at Dulles and found a monorail to Rifton, the satellite-city where Mom was living.

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It was refreshingly small after vast Geneva, even though it spread over a larger area. It was a pleasing, diverse jumble of various kinds of buildings, only a couple more than a few stories high, arranged around a lake, surrounded by trees. All of the buildings were connected by sidewalk to the largest place, a Fullerdome with stores and schools and offices. There we found a directory that told us how to get to Mom's place, a duplex on the lake.

We could have taken the enclosed sidewalk but instead walked alongside it in the good cold air and smell of fallen leaves. People shied by on the other side of the plastic, carefully not staring.

Mom didn't answer her door but it turned out not to be locked. It was a comfortable place, extremely spacious by starship standards, full of Twentieth Century furniture. Mom was asleep in the bedroom, so Margay and I settled in the living room and read for a while.

We were startled suddenly by a loud fit of coughing from the bedroom. I raced over and knocked on the door.

"William—I didn't"—coughing—"mean, uh, I didn't know you were . . ."

We went in and she was propped up in bed, the light on, surrounded by various nostrums. She looked ghastly pale and lined.

She lit a joint and it seemed to quell the coughing. "When did you get in? I didn't know . . ."

"Just a few minutes ago. But what about you? How long has this . . . have you been . . ."

"Oh, it's just a bug I picked up in Geneva. I'll be fine in a couple of days." She started coughing again, drank some thick red liquid from a bottle. All of her medicines seemed to be the commercial, patent variety.

"Have you seen a doctor?"

"Doctor? Heavens, no, Willy. They don't have, it's not serious, don't—"

"Not serious?" At eighty-four. "For Chrissake, Mother." I went to the phone in the kitchen and with some difficulty managed to get the hospital.

A plain girl in her twenties formed in the cube. "Nurse Donalson. General Services." She had a fixed smile, professional sincerity. But then everybody smiled.

"My mother needs to be looked at by a doctor. She has a—"

"Name and number, please."

"Bette Mandella." I spelled it. "What number?"

"Medical services number, of course," she smiled.

I called in to Mom and asked her what her number was. "She says she can't remember."

"That's all right, sir. I'm sure I can find her records." She turned her smile to a keyboard beside her and punched out some code.

"Bette Mandella?" she said, her smile turning quizzical. "*You're* her

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son? But she must be in her eighties."

"Please. It's a long story. She really has to see a doctor."

"Is this some kind of joke?"

"What do you mean?" Strangled coughing from the other room, the worst yet. "Really—this might be very serious, you've got to—"

"But, sir, Mrs. Mandella got a zero priority rating 'way back in 2010."

"What the hell is that supposed to mean?"

"S-i-r . . ." the smile was hardening in place.

"Look. Pretend that I came from another planet. What is a 'zero priority rating'?"

"Another—oh! I know you!" She looked off to the left. "Sonya—come over here a second, you'd never guess who . . ." Another face crowded the cube, a vapid blond girl whose smile was twin to the other nurse's. "Remember? On the stat this morning?"

"Oh, yeah," she said. "One of the soldiers—hey, that's really max, really max." The head withdrew.

"Oh, Mr. Mandella," she said, effusive. "No wonder you're confused. It's really very simple."

"Well?"

"It's part of the Universal Medical Security System. Everybody gets a rating on their seventieth birthday. It comes in automatically from Geneva."

"What does it rate? What does it mean?" But the ugly truth was obvious.

"Well, it tells how important a person is and what level of treatment he's allowed. Class three is the same as anybody else's; class two is the same except for certain life-extending—"

"And class zero is no treatment at all."

"That's correct, Mr. Mandella." And in her smile there was not a glimmer of pity or understanding.

"Thank you." I disconnected. Marygay was standing behind me, crying soundlessly with her mouth wide open.

I found mountaineer's oxygen at a sporting goods store and even managed to get some black-market antibiotics through a character in a bar in downtown Washington. But Mom was beyond being able to respond to amateur treatment. She lived four days. The people from the crematorium had the same fixed smile.

I tried to get through to Mike but the phone company wouldn't let me place the call until I had signed a contract and posted a twenty-five thousand dollar bond. I had to get a credit transfer from Geneva. The paperwork took half a day.

I finally got through to him. Without preamble: "Mother's dead."

There was a lapse of about a second while the radio waves wandered up to the Moon and another lapse coming back. He started and

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then nodded his head slowly. "No surprise. Every time I've come down to Earth, the past ten years, I've wondered whether she'll still be there. Neither of us really had enough money to keep in very close touch." He had told us in Geneva that a letter from Luna to Earth cost a hundred dollars' postage plus five thousand tax. It discouraged communication with what the UN considered to be a bunch of regrettably necessary anarchists.

We commiserated for a while and then Mike said, "Willy, Earth is no place for you and Marygay; you know that by now. Come to Luna. Where you can still be an individual. Where we don't throw people out the air lock on their seventieth birthday."

"We'd have to rejoin UNEF."

"True, but you wouldn't have to fight. They say they need you more for training. And you could study in your spare time, bring your physics up to date—maybe wind up eventually in research."

We talked some more, a total of three minutes. I got a thousand dollars back.

Marygay and I talked about it for hours. We went to bed and still talked. Couldn't sleep, rattled on for hours saying the same things over and over.

Life on the Moon would be hard. Few luxuries, military discipline, long hours, constant danger from the environment.

Life on Earth was comfortable. We could sit back and have our needs taken care of, smoke the doctored dope until nothing looked wrong and we were as satisfied as all the other civilians seemed to be.

But right now our minds were clear and we could see that the price of this happy order was total surrender to the collective will. Who wants to be a happy zombi?

On the other hand, being realistic, we would have little enough "free will" back in UNEF. It would be better, of course, than before, being officers—but UNEF could honor its contract for a year or two and then suddenly have us back out in a Strike Force.

But maybe they were telling the truth and didn't want us for expensive cannon fodder; maybe they needed experienced soldiers to train new recruits, to crack the shell of Pollyannish conditioning that every civilian would have.

We talked about these things and for the first time we talked about love. Whether love would better flourish under one set of constraints or the other. Whether the game was worth the candle in either case.

Maybe our decision might have been different if we hadn't been staying in that particular place, surrounded by artifacts of Mother's life and death. But we stopped talking at dawn, when in the cold gray light the proud, ambitious, careful beauty of Rifton turned sinister and foreboding; we

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packed two small bags and had our money transferred to the Tycho Credit Union and took a monorail to the Cape.

X

"In case you're interested, you aren't the only combat veterans to have come back." The recruiting officer was a muscular lieutenant of indeterminate gender. I flipped a coin mentally and it came up tails.

"Last I heard, there had been nine others," she said in her husky tenor. "All of them opted for the Moon . . . maybe you'll find some of your friends there." She slid two simple forms across the desk. "Sign these and you're in again. Second lieutenants."

The form was a simple request to be assigned to active duty; we had never really gotten out of UNEF, since they had extended the draft law, but had just been on inactive status. I scrutinized the paper.

"There's nothing on here about the guarantees we were promised at Stargate."

"What guarantees?" She had that bland, mechanical Earth-smile.

"We were guaranteed assignment of choice and location of choice. There's nothing about that on this contract."

"That won't be necessary. The Force will . . ."

"*I* think it's necessary, Lieutenant." I handed back the form. So did Marygay.

"Let me check." She left the desk and disappeared into an office. She was on a phone for a while and then we heard a printer rattle.

She brought back the same two sheets, with an addition typed under our names: "GUARANTEED LOCATION OF CHOICE [LUNA] AND ASSIGNMENT OF CHOICE [COMBAT TRAINING SPECIALIST]."

We got a thorough physical checkup and were fitted for new fighting suits. The next morning we caught the first shuttle to orbit, enjoyed zero-G for a few hours while they transferred cargo to a spidery tachyon-torch shuttle, then zipped to the Moon, setting down at Grimaldi base.

On the door to the Transient Officers' Billet, some wag had scratched, "Abandon hope all ye who enter." We found our two-man cubicle and began changing for chow.

Two raps on the door. "Mail call, sirs."

I opened the door and the sergeant standing there saluted. I just looked at him for a second and then remembered I was an officer and returned the salute. He handed me two identical 'faxes. I gave one to Marygay and our hearts must have stopped simultaneously.

"They didn't waste any time, did they?" Marygay said bitterly.

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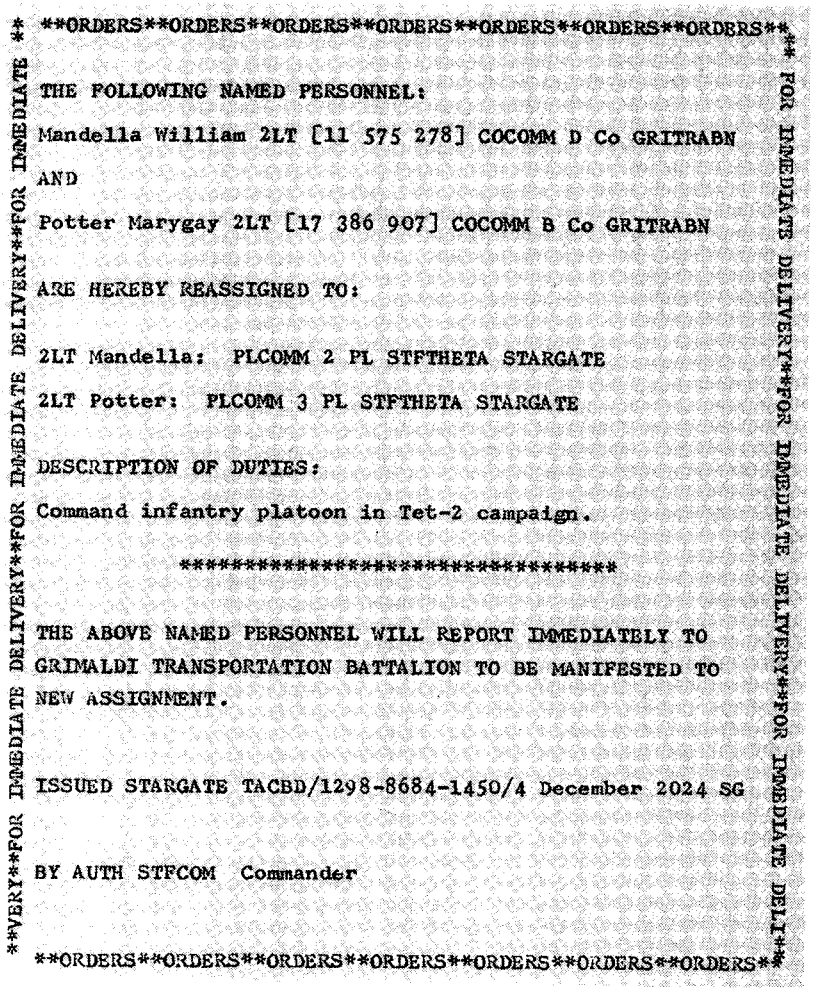
VERYFOR IMMEDIATE DELIVERY**FOR IMMEDIATE DELIVERY**FOR IMMEDIATE DELIVERY**FOR IMMEDIATE **
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THE FOLLOWING NAMED PERSONNEL:
Mandella William 2LT [11 575 278] COCOMM D Co GRITRABN
AND
Potter Marygay 2LT [17 386 907] COCOMM B Co GRITRABN
ARE HEREBY REASSIGNED TO:
2LT Mandella: PLCOMM 2 PL STFTHETA STARGATE
2LT Potter: PLCOMM 3 PL STFTHETA STARGATE
DESCRIPTION OF DUTIES:
Command infantry platoon in Tet-2 campaign.
****
THE ABOVE NAMED PERSONNEL WILL REPORT IMMEDIATELY TO GRIMALDI TRANSPORTATION BATTALION TO BE MANIFESTED TO NEW ASSIGNMENT.
ISSUED STARGATE TACBD/1298-8684-1450/4 December 2024 SG
BY AUTH STFCOM Commander
ORDERSORDERS**ORDERS**ORDERS**ORDERS**ORDERS**ORDERS**
** FOR IMMEDIATE DELIVERY**FOR IMMEDIATE DELIVERY**FOR IMMEDIATE DELIVERY**FOR IMMEDIATE DELI**

Must be standing order. Strike [illegible] Command's light-weeks [illegible]. They can't even know we've [illegible] yet.

"What about our . . ." She let it trail off.

The guarantee. "Well, we *were* given our assignment of choice. Nobody guaranteed we'd have the assignment for more than an hour."

"It's so dirty."

I shrugged. "It's so Army." But I had two disturbing feelings:

That all along we knew this was going to happen.

That we were going home. ■

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Epicycle

A theory doesn't have to describe the real world to be true—and helpful!

P. J. PLAUGER

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"Thar she blows! Hot and straight!"

I could hear Jenkins' reedy voice reverberate inside the control module, almost enough to restore the timbre muffled by his work helmet. No trick of acoustics could correct for his garbled slang, though. Kids these days weren't even taught that Connecticut once had thriving seaports. I guess you can't expect them to distinguish between the jargon of a whaler and a submariner.

It was the sailors who owned the stars in those days. If you don't believe me, take a look at a constellation map of the Southern Hemisphere. People bold enough to venture into strange waters didn't hesitate to write their words all over the sky. No ancient gods for them—the Clock and the Telescope helped them find their way. Sailors were a pretty good bunch, considering they were all men.

But now the NASA career types are starting to call themselves a navy. (Congress already gave them the stars.) Boys like Jenkins and Scott playing grownup. I hear the latest style at Skyhook is wearing one tiny gold earring, pirate fashion, and smoking tobacco. Machismo is alive and flourishing in orbit, my friends.

The Orbital Booster System was surely near burnout and separating rapidly. Even on attitude jets alone, those pigs could rack up a respectable delta-V in pretty short order. Not that I could see all this, mind you. Regulations required that control module ports be protected from pitting, whenever possible, during close maneuvers. You can bet my two little helpers would do all the "protecting" the law allowed.

They wouldn't even let me outside! My one and only trip into space, aborted before it really began, and those acned Tom Corbetts lacked the decency to let me stick my head out the hatch. Regulations again, of course. Let me tell you I'd had it up to here by then with NASA's damned regulations. I wanted to stomp my feet and bawl, but naturally I couldn't do either one.

The stomping was physically impossible, as you can well imagine; but the crying was equally forbid-

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den, even though it violated no physical law. Gallant explorers of the spaceways never cry, you see. They are brave and tough. Men, that is. Manure.

Shuffling and clanging noises. One of the two was entering the lock. I assumed the fireworks were over, such as they were. Rockets aren't very impressive in vacuum—they just show a sort of pointy glow. Or so I'm told. Still, I wish I could have watched.

The inner door swung open and a red-banded bubble head fluttered out. I recognized the species as a NASA lieutenant—I could tell it was Jenkins by his markings. He closed the hatch and started the cycle for Scott before unsuiting. I tried to look as if I hadn't been trying not to cry.

Frizzy hair tufting out in all directions, eyes somehow never quite in focus. Lieutenant Jenkins was the archetypal mathematician. Everything was right angles and planes in his young world. I'm certain he regarded the merciless vacuum around us as just a satisfyingly zero nothing. Me, I was a troublesome curvilinear boundary condition in his otherwise perfect world.

"OBS is disposed of, ma'm," he said, as if he suddenly remembered I was there. You'd think he'd just interrupted his homework to take out the garbage for mommy. I'd offered to compute a suitable disposal maneuver for the malfunctioning booster, in fact, but Jenkins had reacted with hurt pride and horror. That was man's work.

"Very good," I replied as offhandedly as I could muster. It was somehow necessary to keep up the pretense that I was commanding the mission, even though my wishes were overruled at every turn.

More clanging noises. The next time that lock cycled, I would be going through it into Skyhook. Two days from then I'd be swooping into Houston, leaving behind a hundred meters of unexposed film and a quarter century of wasted dreams. My eyes began to burn—something in the air—so I studied the communications console intently while Scott entered.

They had finished stowing their working gear by the time I looked up. Scott already had his comic book out. He was unbelievable. We used to joke about the illiterate engineers at school, but the truth was they could ace any liberal arts course they set their minds to, and we knew it. They just didn't have much truck with anything they couldn't apply.

But Scott, I think, was truly semi-literate. You could see his lips move slightly as the balloons and simple figures drifted by. The scan rate was set at MIN, of course, and he still keyed HOLD from time to time. Put a flattop on that blocky head and a varsity letter on his tunic and you could lose him in any of the old football factories.

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In fact I wish you would.

I resigned myself to twenty-five hours of inaction amid poor company. Once the bad news was in, that we'd have to ditch the OBS and return, I'd promptly computed a Hohmann transfer to the emergency backup booster orbiting at eighteen thousand kilometers. We could have left ten and a half hours after separation—why hang around with nothing to do but float and stare at each other? But NASA had to do it the company way, as usual, and burn computer time to verify my calculations.

They couldn't admit I was right, even though it was common knowledge that I could practically do orbit calculations in my head. So they set up a flight plan for one synodic period later, muttering something about perturbation corrections. Result, we had to rot an extra fourteen-odd hours in synchronous orbit.

We really didn't have to abort. I mean the control module had a self-contained life-support system and enough juice in her jets to handle alignment maneuvers (more than enough, alas!). Skyhook could have let us do my experiment and come get us later. There was precedent for that.

But those damned regulations got me again. As long as a spacecraft has status critical and enough thrust to make it to safety, rules say it's gotta come home to poppa. Pronto. We could just make it to our backup on a minimum energy transfer orbit inside (regulation) tolerances—provided we did no station-keeping maneuvers beforehand. So a perfectly viable experiment had to be scrubbed in the interest of "safety." Bah!

I couldn't argue with the "condition critical" designation. A stuck damper rod in an OBS pile can lead to a lot of radiation that I'd rather not have around, thank you. It wouldn't go boom, but in the six or seven days it spent slagging down, the pile would use up a year's supply of fissionables. And that makes for a lot of neutrons.

(Of course, all it needed was a well-placed kick to break the rod loose, and I knew exactly where to aim. The radiation hadn't built to an intolerable level yet. I won't repeat to you what Skyhook said when I offered to go back and fix it. My thesis adviser said something similar when I repaired a hundred kilovolt Cockroft Walton on the fly with a bobby pin at three a.m. one morning. When the data's coming in, a grad student will do anything to keep it coming.)

But we'd disposed of the damned booster and we'd already reached station—and the Comsat tender was due out in three weeks and could pick us up with very little extra fuel expenditure. Our life support was good for five weeks. It seemed only natural to save a ten-million-dollar investment and let me do my thing. Or so it seemed to me.

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I reasoned and argued with Skyhook for three hours. I wheedled and pleaded. But I knew it was a losing battle. Being the first civilian woman to make it into space, I'd already used up all the good will I could scrounge. Those NASA cowboys weren't about to leave a lady in distress, even if she liked it there.

So there sat I within five meters of a lifelong goal, hamstrung by fate and a sexist bureaucracy. Jenkins was playing with the calculator—chess, it looked like—and Scott was still wrapped up in the adventures of Aquaman or somesuch. Real fun people. I began to brood.

It all started when I was in college. Well anyway, that's when my plan crystallized; I'm sure you could trace it back to my toilet training if you tried hard enough. But that was when I started getting ready for space.

You see, I was always interested in astronomy. Daddy bought me a refractor when I was nine and I'd built my first Newtonian before I'd been kissed. A crisp, winter night would keep me enthralled for hours. Long after my brothers were driven in by the numbing cold, I'd be happily thumbing through Norton's for another binary star.

"Margo, are you still out there?" was my mother's standard midnight plea. And, "Don't you ever sleep?" when she caught me out before dawn. But she let me have my way, and I flourished under the stars.

I picked a college on the basis of its optics, two ten-inch reflectors and a sixteen-inch Cassegrain; but college came through with three delightful surprises—astrophysics, computers, and men. Those have been my principal loves ever since (though not always in that order), and wellsprings of endless joy and grief. But I'm forgetting about my plan.

Astrology was having a renaissance about then, and the charlatans were really cleaning up. One of the cuter of these frauds, an English major in real life, asked me to help him with his math (he couldn't read an ephemeris the same way twice to save his soul). So one thing led to another and I ended up writing a computer program to cast horoscopes.

Not the numerology garbage, mind you. I just placed the planets in the houses and left the interpretation up to him. I got ten bucks rakeoff from his twenty-five-dollar fee and kept a clear conscience. Writing the program was good exercise and besides, he really was cute.

(After twenty years of haggling with university and government committees, I have come to regret that early self-righteousness. I could have used the practice in duplicity and doubletalk, not to mention the extra fifteen dollars!)

But there I was at the computer

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console, one cloudy night, when the idea sprouted. Sooner or later the space program would have to open up to civilian researchers, much as the national labs did to help justify their continued existence. It would take a good reputation to get sent into orbit plus an experiment that needed expert on-site tending. I've never been handicapped by false modesty, so I knew even then I could meet both those requirements in time.

Time was the dominant variable, as it so often is in astronomy. By guess and by golly I settled on the early 1980s as the politically opportune time. That would put me in my forties, but then most of the early astronauts were around that age. Physical condition would count for a lot, but I'd always kept pretty trim. I resolved then and there never to miss my daily session in the swimming pool—and except for a couple of bear two children I've kept that promise pretty well.

So all right. I was headed for space. When to go was still the question. That was when I had my stroke of genius. I would cast my own horoscope—only in reverse. After minutes of eager dialogue with the number cruncher sealed my fate. I would be going into orbit in the spring of 1984.

It was mostly a matter of plotting the elongations of all the planets—how far away from the sun they appear as a function of time. The Messier objects, galaxies and such, are fairly sparse around Aries (that's where the sun is in late March—sorry if I keep forgetting that not everyone knows his zodiac). So I wanted a favorable arrangement of planets in the spring, if possible.

I hit the jackpot. In the spring of 1984, Venus would be just past greatest elongation and swinging toward Earth. Mars would be in opposition, about as close as you could ask. All the outer planets would be far enough from conjunction for a good view, and even Mercury had a chance to be seen. So long as the sun didn't get too rowdy, sunspots and all that, I'd be home free.

They say the stars impel but do not compel. In my case that wasn't true. I'd spent the last twenty-five years enjoying life and growing, but I never once lost sight of my target. I won't tell you about all the little triumphs and near disasters along the way (well, maybe just a few). It was proof enough of my perseverance that I kissed my family good-bye and lifted off on schedule—a quarter-century after I set my goal.

And there I sat thirty-five thousand kilometers out in space, having done everything right along the way, thwarted by a damned stick of carbon.

Jenkins was beginning to tire of his chess match, and Scott had long since sacked out. Keeping up with

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Aquaman can be pretty grueling. I suppose I should have been lapping up the view through the ports, but it was such a poor second to what I really wanted that I didn't have the heart. I made an effort to be sociable.

"Is this your first trip out to synch orbit?" I opened. Most work is done below the Van Allens, so it was a moderately intelligent question to ask.

"Oh no, ma'm," with a worldly air. Then, suspecting that I might know the truth, "Well, actually, it's my first *orbital* assignment this far out. But my sophomore outing was circumlunar. We got to do an out-and-back to drop off some repeaters." A little warmth had crept into his manner, for the first time since we'd met.

"They let me do the translunar injection," he said with pride, "and they didn't need any course corrections until halfway back."

So that was it. I wonder if he bothered to look down at the Moon as they swung around it.

"You did a pretty accurate job of putting us on station," I added. A little flattery never hurt. "I haven't detected any drift since we got here." Actually, we were fast by twelve kilometers per hour by my measurements, but what the hell.

"I always park on a dime," he preened. Then, in a conspiratorial whisper, "Scott is consistently three-quarters of a second fast on engine shutdown. He beats the automatics every time. Once you learn to correct for systematics like that, it's just a matter of careful navigation." We shared a chuckle.

"I guess engineers never learn to appreciate precision," I opined. Jenkins nodded sagely. "You know, back when I was in school, we used to tell engineer jokes—just like the British jokes people tell now." We also told mathematician jokes, but I didn't mention that.

"In fact, it's kind of funny. This crew, I mean. A mathematician, a physicist and an engineer all in the same situation. That was the format for a lot of the stories."

I hesitated, then decided to take a chance on offending the boy.

"Have you ever heard the theorem that all odd numbers are prime?"

He looked at me suspiciously.

"No, seriously," I hurried on. "If you were to ask a mathematician to test it he might say: 'Let me see, now. One is prime, three is prime, five is prime, seven is prime. Nine? Nine's not prime. Clearly the theorem is false.'

"But a physicist is more pragmatic. She, I mean he," the slip was calculated, and had the usual effect on a male listener, "might say: 'Let me see, now. One is prime, three is prime, five is prime, seven is prime. Nine? That may be an experimental error—let's go on.'"

Jenkins smiled.

"Eleven is prime, thirteen is prime, fifteen is . . . Well, that's a

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lot of data points. The theorem is probably true.' "

He laughed outright.

"But if you ask an engineer to test the theorem, he might say: 'Let me see, now. One is prime, three is prime, five is prime, seven is prime, nine is prime, eleven is . . .' "

A guffaw interrupted my narrative, as it always does at that point. I had finally gotten through to part of my crew for the first time.

"That ain't so funny," Scott rumbled like a bear disturbed in midhibernation. The laughter must have awakened him. Oh well, win one, lose one. I was back to zero again.

But at least we were talking. I decided to borrow against Jenkins' good will and stick my neck out a little farther. What did I have to lose?

"There's also the story about the mathematician and the engineer who are put across the room from a pretty girl," I began. Both heads were perked. "A booming, hidden voice informs them that they may only cover half the remaining distance to the girl every ten seconds. Then he unleashes a spectacular lightning bolt against the wall to show that he means business.

"What do they do then? Well, the mathematician just sits down in place, because he knows you must make an infinite number of moves to cross the room under the conditions stated." Jenkins gave a satisfied nod.

"But the engineer immediately sets off for the middle of the room. While he is waiting there for his next turn to move, the mathematician calls to him: 'Don't you know you can never get across a room if you're only allowed to cover half the remaining distance each time? Why are you wasting the effort?'

"And the engineer replies cheerfully: 'Sure, I know I'll never get all the way there. But after a while I'll get close enough!' "

It was Scott's turn to gloat. Jenkins was abashed, but he took it well. This was more like it.

"Gee, it's too bad we have to abort," said Jenkins. "I mean, you must have worked a long time to get ready for this mission." If only he knew.

"Maybe they'll be able to reschedule you soon, ma'm," Scott ventured. "I hear the waiting list is under two years now." Yes, but time and planets wait for no man. Or woman.

"Maybe," I said with a brave little smile. Actually, I knew I'd be lucky to make orbit ever again. I had to step on a lot of male egos to get out this once. It was this time or bust, and I had gone bust.

Jenkins swung over to the situation display. "Radiation's down to forty millirems, ma'm," he reported, "and still dropping. At least we won't be fried alive now that the booster's out of the way."

"There's that to be thankful for,

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I suppose." It was the most cheerful thing I could think of to say. But I couldn't help adding, "I wish I could have watched the sendoff."

Jenkins caught the reproach, but Scott was his usual thick-skinned self. Relentlessly, he charged in.

"Yeah, that was fun to watch." His eyes shone. "Old Jenkie dropped her straight down the pipe. The OBS was still pointed dead on Earth center even at burnout." Jenkins straightened with pride, ignoring my misery. It was time to change the subject.

A little vindictively, I began, "You know, I just thought of another of those stories we used to tell back in school." Again, my entertainment-starved audience was all ears.

"This is about a hotel, where a mathematician, a physicist and an engineer are spending the night in separate rooms. Late at night a fire breaks out and spreads rapidly to each of the rooms. What do you suppose they do?

"Well, the engineer wakes up, smelling smoke. He sees the fire and quickly dashes out into the corridor, grabs a fire extinguisher off the wall, runs back to his room and drowns the flames. For safety, he then soaks the walls, ceiling, floor and mattress. Tossing the empty extinguisher aside, he climbs into his soggy bed to get what sleep he can.

"Then the physicist wakes up, smelling smoke. He sees the fire and quickly dashes out into the corridor, grabs a fire extinguisher off the wall, runs back to his room and makes a brief test blast. After a quick calculation, he aims a four-second blast at the base of the fire and puts it out. Setting the extinguisher next to his bed, he lies down to rest and watch for another outbreak."

That was my favorite part.

"Then the mathematician wakes up, smelling smoke. He sees the fire and quickly grabs a pad of paper and a pencil. He makes a number of calculations, glances at the fire, makes a few more. After a while, he wanders into the bathroom, turns on the tap and dabbles his fingers in the water. Looking back at the fire, he smiles and says: 'Aha! A solution exists!' Then he goes back to bed."

Stony silence.

"Well, I think I'll get some sleep," I interjected into the void. To hell with them.

I hung in my bunk netting, wide awake and contrite. Revenge is fun at first, but it always leaves a bitter aftertaste. My mind automatically went back to my last petty victory, over General Walker.

He sat behind his large walnut desk in his dark paneled office. Leather upholstery and bronze plaques, a cigar humidor perched on one corner of the vast empty desktop. It was a real bastion of masculinity, a holdout in a chang-

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ing world. I almost felt sorry for him, except that he was getting between me and where I wanted to go.

"But you must be reasonable about this, Mrs. Dixon," he said for the third time.

"My husband's surname is Sachs," I replied tersely. "So the form of address you're groping for is Mrs. Sachs. Professor Dixon is more suitable, however, in the present context. Dr. Dixon or Ms. Dixon are also acceptable."

"And I am being reasonable."

"But we have no facilities for women in space."

"What facilities do you think I'll need that are missing?" He blushed. He actually *blushed*. "I can assure you that there is nothing about the control module that will inconvenience me."

"You might require first aid. Accidents happen. It might be necessary to [illegible]."

"To undress me? I'm sure any of your men can handle that. And believe me, if I need first aid I'll welcome their assistance." Yeah, and what if I have to lift a heavy weight in zero gravity? Or what if I [illegible] a sick child from twenty-two thousand miles out?

"Surely there is someone else who can tend your remote gear. A subordinate perhaps." A man, you mean.

Look, I plan to deploy the biggest interferometer ever sent into space. I'm going to need constant tending just to keep it aligned within tolerances, not to mention watching for design bugs. That's not an off-the-shelf item, you know."

Walker started to speak, but I overrode him.

"And I've got three hundred hours of computer time committed at Livermore, just to process enough data in real time to do a meaningful scan. That's why I need to go out to synch orbit, to maintain a continuous wideband link with the big machine. Do you think I could leave that in the hands of an assistant?"

I knew the magnitude of the project didn't particularly impress him; everything that was done in space was grandiose on some scale. But I was sure he'd fall for the personal attention pitch. NASA was overburdened with college kids on work-study programs, passing themselves off as professionals. Government agencies haven't been the same since the Educational Relevance Act was passed.

"I see," said Walker in a tone that said he didn't see at all. "Perhaps this experiment has not been properly thought out, if it requires such delicate attention. It seems to me that a re-evaluation is in order. Perhaps at some later time . . ."

"General Walker," there were ice daggers in those two words, "this experiment has already been approved by the University Coop, by NASA and by the National Science

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Foundation. There is only one delicate component in the system and that is me. Your job is neither to approve nor disapprove, but to assist me in preparing for space, to get me there, and to bring me safely home. You are a bus driver."

We glared at each other for long seconds, then his scowl dissolved into a superior smile.

"I may be a bus driver in your eyes, *Professor* Dixon, but I'm a well paid one. And I'm paid, as you so aptly pointed out, to ensure the safety of my passengers. If I don't think you are physically or *psychologically* fit to endure the rigors of spaceflight, then I am empowered and duty-bound to bar you from space."

The old technical competence dodge, in a new guise: we're not really trying to keep her down, we just wouldn't want to see her overreach her capabilities and suffer failure. I stood up.

"Very well. I'm sure Senator Norwood will want to be informed of this change in policy as soon as possible. If you'll excuse me, I have a luncheon date with him."

Weary exasperation replaced the smirk. Walker must have names dropped all over his carpet every week, by everyone with a bone to pick with NASA. At least I had a name to drop that was too big to ignore.

"Now what makes you think there's been a change of policy, Professor Dixon?" He made some effort to sound soothing, anyway. "Perhaps you simply don't have a clear understanding of the terms of the Cooperative Space Research Effort."

Got him!

"And perhaps I do. Jimmy Norwood and I went to school together. I was one of his science advisers when he drafted the COSPARE bill." I started toward the door. "I suggest you reread it, before the Congressional hearings start. You should have no trouble recognizing the sections I wrote." My hand was on the doorknob. "I have a tendency to carelessly split infinitives," I said carefully.

"All right, you win." Just like that. I had to hand it to Walker, he knew when he was licked and didn't waste time bellyaching about it. By the time I'd turned around he had a medium-sized telephone book in his hands.

"You will report in at Houston at your earliest convenience for your pre-training physical." That meant right away, of course. "If you pass that, then you can begin the standard training course. And don't forget this." He shoved the phone book at me.

In one of those ugly U.S. Government Printing Office type fonts, the cover primly advertised, "Uniform Code of Operating Regulations for Civilian and Military Personnel in Space and Space-Related Activities. This manual is required reading for all personnel." I

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flipped through it. The print was small.

"Since you will have an independent command, you will be expected to be reasonably familiar with these." His expression was bland as tapioca. "We'll make the OPREGS exam part of your pre-training certification, just to get it out of the way."

I don't remember what else we said, if anything. I came to about twenty minutes later in the back of a cab, the phone book lying open on my lap. The preface informed me that the manual was the basic reference for a *one year* course in space law for academy seniors. I had four days at the outside to absorb it, and I didn't even have the tutorial text that went with it. Walker's revenge.

I thought about complaining to Jimmy Norwood, then changed my mind. It was one thing to go to him with a clear-cut case of obstructionism, but harassment was a harder thing to prove. I felt a little guilty about bringing his name into this in the first place—it was an act of desperation employed only after all else had failed.

Not that I would have hesitated to ask Jimmy's help, if it came to that. We were pretty close in college and had remained good friends even after he left astronomy for law and politics. He and I had developed some delightful ways to keep warm in the observatory shack while waiting out time exposures. But that's another story.

I learned that book. After the first fifty pages I began to detect the underlying philosophy. After the first hundred it was clear that the text was just going into variations on the same basic theme, as government manuals love to do. Once I rewrote it in Backus-Naur Form, the whole body of regulations could be written on two sides of a sheet of paper.

I'm still the only person who ever got a perfect score on the OPREGS final.

The rest of the certification was a breeze. I average a mile a day in the pool, so I have more stamina than most teen-agers. The only thing that worried me was my vision—I'm 20/25, but I can fake 20/20 for a while by squinching up my eyes the least little bit. I made it all right. Still, it would have been a lot easier if I hadn't insulted Walker so much. I guess I'll never learn how to handle insecure men.

I hung in my bunk and tried to relax. Zero gravity was a novel sensation, an experience I had been looking forward to for a long time. I should have been savoring the feel, memorizing it with my entire body; but the dull ache of disappointment kept intruding.

I remembered all the cloudy nights, the missed conjunctions and transits. Almost as bad were the nights when the air was clear but the "seeing" was poor. I used to

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stare for hours at the shifting image of Mars, trying to pin down his squirming features, trying by sheer effort of will to still the turbulent soup of air overhead.

One of my earliest memories was of going to a parade with my father. Because we were several rows back from the edge of the crowd, he put me on his shoulders so that I might also have a view. But in front of us were taller fathers with children of their own aloft. Crane as I might I couldn't quite glimpse the clowns and the majorettes. I bawled and screamed in frustration. *I wanted to see.*

Just on the other side of that hull the stars shone hard and bright. No clouds, no air, no tall men to block my view. And I had lost my excuse for going outside.

I tried to console myself with the knowledge that I'd only lost an hour or two at best. I had expected my crew to be kept busy with attitude corrections to keep the beam aligned. That would leave only me available for the outside work.

But Jenkins was so damned precise that corrections would only have been needed once a day. As experienced vacuum workers, regulations required (you guessed it) that they relieve me of whatever outside duties their time permitted. It would have been a fight to get out the lock even once.

I hadn't counted on that when I first formed my plan back in school. Nor had I expected the feminist revolution to stop as short as it did. Nor, for that matter, would I have guessed that children like Jenkins and Scott would ever supersede mature adults in the exploration of space. I guess you really shouldn't try to plan your life decades at a time.

Still, things were better. Not so long ago, Jenkins might have died young in a Harlem slum before he even learned trigonometry. And I hadn't done all that bad. I had a good husband, two fine daughters, and a successful career. Few women are granted all that. And even if my career were dented a bit, and my daughters rather horrified at the antics of their elderly mother (there are no severer critics of one's social behavior than teenage daughters, believe me), still I had George.

I remember the night we met. General exams were over and I had passed. Beer flowed and music blared and I was letting it all hang out. There is a peculiar frenzy that sets in after weeks of study and tension, and I was in the full grip of it. To this day I can't remember who I was dancing with; but I know we cleared the floor and infected the band with our madness because they kept playing and playing and faces ringed us in on all sides.

It ended in an explosion of cymbals and applause and I was still floating when we got back to our table. I sort of knew George, but

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he was a theoretical physicist so we'd never crossed paths before. Anyway, there he was at our table, holding a beer in that precise way he has and scanning my sweaty body with his misty green eyes.

"Hey George," said a drunken voice, "what do you think of our Margo? Hey?"

He gave me another scan, as if to recheck his earlier findings, and said, "It's not obvious to me that you conserve momentum."

That was the sweetest thing anybody could possibly have said to me.

Before the night was out I had told him of my plan to get into space. I'd never told a soul before then. He confided that he wanted two children, and would probably need help since he was a man. I asked if he had any preferences on their sexes and he said no, just so long as they were happy. I allowed as how I could probably help, then, if he didn't mind the space business. He shrugged.

Eventually we got married.

George proved to be everything advertised, but I could never interest him in astronomy. Too overrun, he said. Astrology turned him on, though. He worked out this beautiful variation on the classic interpretation, where you match the first derivatives of the attributes at the cusps, or something like that. I could never really be sure whether he was pulling my leg or not.

We both agreed that the Ptolemaic theory was a lot more fun than Kepler's laws. There was a baroque charm to the idea of crystal spheres rotating majestically about Mother Earth, each planet dutifully revolving about its assigned epicenter in its proper sphere.

I drifted off to sleep, circles whirling upon circles in my brain.

I came awake swinging. Those circles had turned ominous somewhere along the line and I was scared.

Jenkins and Scott were in their bunks and everything was quiet. I checked the consoles. No communications had been recorded, life-support systems were all in the green. Radiation from the Orbital Booster System had dropped to a mere ten times background; that couldn't be what was bothering me. Or could it?

"Scott! Up and out!"

"Wh . . . what? What's going on?" He looked more like a bear than ever.

"What did you say before about the OBS, when it reached burnout?" He read the tenseness in my manner and stopped to think, for once.

"Why, uh. I said it was a perfect drop."

"You mean the delta-V was straight toward Earth?"

"Yeah. All the way."

"That's really great," I said in exasperation. "We'd better get the

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hell out of here, now!"

Jenkins stuck his head out of his netting. "What for? We made a good drop. At Skyhook we call that the garbage burn, and we've used it hundreds of times."

My exasperation deepened. "At Skyhook you had an atmosphere three hundred miles below you to eat your garbage on that trajectory. Think, man! We're thirty-five thousand kilometers out. You didn't drop that OBS down, you shot it straight up. And it's going to come crashing down on us all in, uh," I glanced at the chronometer, "twelve hours and seven minutes."

Jenkins still looked skeptical.

"Take a look at the radiation record," I said.

He scooted over to the situation display. "It's lower than ever," he retorted.

"Yes, but did you notice that it's stopped decreasing? And the source is in front of us now, not below. That OBS will begin closing on us again in just a few minutes, and even if it misses by a hundred miles we'll still get a pretty bad dose. The pile's really going to town now."

I thought about our alternatives. My transfer calculations were for a departure an hour and a half earlier, and I knew we didn't have the fuel to fly a reasonable catchup. The next Hohmann window would not be for another thirteen hours—that was NASA's flight plan. We would be fried long before then.

I wondered what idiot decided that an eighteen-thousand-kilometer orbit was halfway home from thirty-five thousand kilometers out. Angular momentum is the coin of the realm in orbit, not radial distance. A ten-hour orbit makes for a fourteen-and-a-half-hour synodic period at synch radius. With just enough fuel to make the cheapest possible transfer, a distressed control module could have to wait a dangerously long time before reaching safety. Why was I thinking in such abstract terms? We *were* in danger.

We would have to jump out of the way of that booster, and we couldn't jump anywhere that would do us any good. Whatever we did would leave us stranded. So it was a matter of picking a convenient place to jump to, where we could stay clear of the OBS and be easily picked up.

A beautiful white light exploded in my brain.

"All right. Battle stations, everybody. Scott, prepare to burn in three minutes." That would put us twelve hours on the button since separation. Beautiful.

"But, ma'm," Jenkins protested, "we have to get clearance from Skyhook."

"Not in an emergency, Buster. Section III, paragraph 17, part a." I could wield regulations with the best of them.

"But you haven't even computed an orbit yet." He waved his hand

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entreatingly toward the calculator.

"Oh yes I have." I was downright jaunty. "I used astrology. My horoscope says that we're going to go for a ride on an epicycle." Jenkins got that suspicious look again.

"Mr. Scott, what delta-V did you give the OBS?"

He looked at his crewmate, then back at me. I scowled.

"Uh, five thousand, ma'm."

"Fine. I want the same delta-V for us, along the same line. You fire in exactly one minute . . . mark! Is that understood?"

Scott squirmed, looked at Jenkins. "Well, uh . . ."

"Mr. Scott, I have issued you a direct order in an emergency situation. You disobey me at your peril. Is that clear?" I didn't think people spoke like that in real life. It was hard to believe that anybody with a lick of sense would really be scared.

"I repeat! Is that clear?" I had a tough time keeping a straight face.

"Uh. Yes, ma'm."

"Jenkins?"

"Yes, ma'm."

We strapped in and Scott set up the thruster controls. It was somehow anticlimactic when the rockets came on—first attitude correction, then main drive—and then went off. We could never rendezvous with the backup booster now.

Jenkins reached casually toward the communications console.

"Before you check in with your keepers," I interposed, "how would you like a brief lesson in orbit dynamics? Or are you quite prepared to defend your negligence and stupidity?"

He bridled. "What do you mean, stupidity?"

"It was negligent of you to try a garbage dump from synch orbit—if you'd thought at all you would have known it wouldn't work. But you were downright stupid to try it in the first place!

What if you'd succeeded? Did you really want to dump a hundred kilograms of highly radioactive junk in the upper atmosphere? Why, the U N would have your hide for the fallout that could have produced."

Jenkins blanched.

"That book of regulations and Standard Operating Procedures you love to cite is great for intimidating uppity broads, but it's no substitute for thinking. Why, Ptolemy could have done a better job than you. Look."

I grabbed a pencil and pad.

"We started out with everything going around in a circle together." I drew a circle, put a tiny Earth at its center. "When you fired the booster, you put it on an elliptical orbit that passes closer to the Earth at first, then farther away." I drew an ellipse that snaked in and out of the big circle.

"How do you know that's how the orbit looks?" asked Jenkins. "Kepler's laws aren't that easy to integrate."

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"They certainly aren't. But we physicists are shifty. We do things the easy way whenever possible. In this case I used a little applied astrology." That look again.

"O.K., I'll do it just using Kepler's laws—but I still don't have to integrate them.

"Once its jets shut down, the OBS was in free fall around the Earth, right? That means it was following a closed orbit from then on and so must return to that same spot in space one period later.

"But what is its period? Kepler's third law says the period is determined solely by the length of the orbit's semi-major axis. When you blasted straight toward Earth, you made no change in the booster's angular momentum. So its equilibrium orbit is still the circle we were on, and the booster must oscillate inside and outside our old path, keeping essentially the same semi-major axis length."

Scott was listening intently. My opinion of him went up about ten points.

"That's just another way of saying that the period of small oscillations about a circular orbit is the same as the orbit period. Ergo, our booster has pretty much the same orbital period as we did, near as no matter. If we had not moved, we would have rejoined our unwelcome OBS almost exactly twenty-four hours after we kissed it goodbye."

Scott whistled.

"Then why do they use that orbit for disposal at Skyhook?" he ventured.

"Probably because the Earth looms so large that 'down' is psychologically obvious. At Skyhook you can afford such mistaken notions because the upper atmosphere will drag stuff down from nearly any variant orbit before even one revolution.

"A better disposal orbit would be to burn back along the orbit line, because it gives you the greatest drop, or narrowest ellipse, for a given amount of thrust. And it shortens the period markedly enough that your trash is not likely to come back to plague you, even if it takes several periods to decay."

I let that sink in.

"But there's an easier way of thinking about orbits, which is why I knew which way we should jump." I keyed ERASE on the pad and redrew my big circle. "An ellipse can be generated by a circle moving around another circle. The Greeks called the big circle the deferent, and the little circle, centered on the rim of the big one, the epicycle. If you go once around the epicycle while the deferent rotates once, you trace out the ellipse."

"I thought that stuff was proved wrong," said Jenkins a little huffily.

"Not wrong, just not as elegant as Newton's theory, which explained Kepler's laws and planetary motions with a minimum of fuss.

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But any *description* that gives the right answer is equally valid, even if you don't believe in the mechanism implied. In fact, Ptolemy wins in our case, because his description is easier to work with. Watch."

I drew a little circle with its center lying on the rim of the big one.

"You put that booster on an epicycle like so. Ptolemy would say that we were on its deferent, though that isn't important. What counts is that we know both periods are around twenty-four hours.

"So where is the best place to hide from our OBS, assuming we can't leave the neighborhood in time? Why, on the opposite side of the epicycle, of course. That's where we just climbed on. Until we're picked up by the Comsat tender we'll stay comfortably far from the radiation."

Now for the fun part.

"And we're also still essentially synchronous, so we can keep in touch with Livermore and do my experiment. Of course, we'll be wiggling back and forth relative to the Earth's surface, so you two will have to tend the radio link continuously. I'm afraid. I figure we can work in overlapping sixteen-hour shifts. I'll have to handle most of the outside work." I put my face in neutral.

Jenkins and Scott looked at each other, back at me, then at each other again. But they couldn't think of a single regulation to get them out of this one. Everyone works overtime in orbit, when necessary.

"Now, why don't you check in with Skyhook and tell them our latest situation. Scott, I can use a hand outside unpacking the interferometer array." Then to Jenkins, "Oh, yes, and tell Livermore we'll be ready for checkout in six hours."

It was good to be in command.

I felt a brief twinge of guilt about some of my actions. There might have been an intermediate orbit, for instance, from which we could still have reached the backup booster without coming too near the hot OBS. We had a few hours to spare, enough time to use Skyhook's computers to advantage. I pointedly avoided contacting them for that very reason. My simple-minded orbit calculations carried much more weight that way.

And the broadband link was programmed to track a very eccentric orbit, if necessary. I had prepared for the worst, not counting on the nit-picking likes of Jenkins. But why tell them? It would give them something to do and keep them out of mischief.

I put those troublesome thoughts quickly aside. Tucked away with the interferometer was a twelve-inch, f4 Newtonian telescope—made with loving care and fitted with all the accouterments twenty-five years of dreaming could envision. I had pictures to take and planets to see.

And there wasn't a cloud in the sky. ■

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P. Schuyler Miller

THE PARABLES OF LAZARUS LONG

The last time I heard John Campbell speak at a science-fiction convention, he was urging writers to stop reworking the tired old themes of the physical sciences and begin extrapolating the theories and discoveries of the "new biology." This was long before the term "molecular biology" had been coined, at least publicly, and I think it was before the double helix had been brought into the spotlight. (I have no doubt John knew it was waiting in the wings for its cue.)

In his new 605-page addition to his "Future History" series, "Time Enough for Love" (G.P. Putnam's Sons, New York; 1973; $7.95), Robert Heinlein shows that he took John's advice to heart, or was already anticipating him. This is a book that extrapolates the relatively primitive genetics of the Howard Families program, to which we were introduced in "Methuselah's Children," and plays further variations on the theme of philosophy and sociology of sexual relationships—which was the theme of his previous book, "I Will Fear No Evil," and to a great extent of "Stranger in a Strange Land."

At this point, I want to urge on you a course that I admit I haven't had time to follow myself. Read "Time Enough for Love" in conjunction with "The Past Through Tomorrow," the compendium of most of Heinlein's Future History stories—at least with "Methuselah's Children," which introduces you to the Howard Families, their escape into space, their wanderings among the worlds, and their return to the Earth which had intended to destroy them. It also introduces you to the oldest of them all, Lazarus Long. The new book is all his: his reminiscences, his philosophy (of which you saw some excerpts here, last June) and his return to the Kansas City where he was born Woodrow Wilson Smith on November 11, 1912.

I also suggest that you read Alexei Panshin's "Heinlein in Dimension," published in 1968 by Advent, for his discussion of what he calls "the Heinlein Individual." Because Lazarus Long *is* the Heinlein Individual—not as real here as he has been in other books and other guises, but nonetheless unmistakable.

The Howard Families, thoughtfully bred for long life, good health, and superior intelligence since the Nineteenth Century, fled

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into space in Earth's first starship (A.D. 2136). They returned after seventy-four years of wandering, to find that Earth had developed the rejuvenation techniques the genetically long-lived Howards had been accused of hiding. They then left Earth permanently, in episodes we haven't heard, to form a new home world and to populate the Galaxy with Howards. The "ephemerals" followed, and when the new book opens in 4272 Galactic Year 2053 Lazarus Long is 2,360 years old. He is also bored with life, and is about to end it when the authorities of Secundus, the new home world, find him and talk him into one more rejuvenation—so that, among other things, he can tell them about those missing years.

But there is a deeper theme than that. Secundus has a computer, "Minerva," in love with her boss—except that to a computer, "love" is a purely intellectual concept. As he recovers from his rejuvenation, Lazarus Long—the Senior—tells a series of stories which illustrate to Minerva some of the varieties of human love. For the Families' geneticists have a technique which can impress a computer's memories and personality on a being created from cloned human cells, so that Minerva can eventually be a flesh and blood woman.

The Heinlein Individual, as Panshin describes him, is the epitome of the competent man. When he is young, in his first stage of development, he may be naive but he learns fast. The Senior tells the story of a young man he knew in his own youth, David Lamb, "the man who was too lazy to fail"—who seems to have some elements of Heinlein's own Navy career in him. (Lazarus also slips in some sly anachronisms that the Howard historians two thousand years from now are too ill-informed to catch. Putting the Naval Academy at West Point, for example.)

There is generally a second-stage Heinlein Individual to instruct the youth, and there may be a third-stage Individual, grown tired and cynical, to advise them both. We see Lazarus Long here as all three, commenting on mankind as a species and a social animal, with emphasis on the "Crazy Years" in which we are now living and which Heinlein-as-Lazarus evidently feels will bring our society crashing down through the years he described in "I Will Fear No Evil."

The least successful part of the book—in fact, it can grow tedious when Lazarus instructs you in genetics—is the story of "the twins who weren't." These are a boy and a girl, products of genetic fiddling, whom Lazarus as "Captain Aaron Sheffield" finds on the slave block, buys, and has to bring up. He forges them into good, competent Heinlein individuals and at the same time teaches Minerva some of the intricacies of sex and love.

The tale of the adopted daughter is a better story closer to the Heinlein norm, which shows you a world and a society instead of telling you about them. Now Lazarus is Ernest Gibbons, a successful businessman on the young planet New Beginnings, who rescues a little girl, brings her up, then takes

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her to pioneer in the back country as one of his many wives—and evidently the one who meant most to him in his long, long life. Buck, the talking mule in this episode, is one of Heinlein's happiest creations.

All through the book, Heinlein is using the "new" techniques, cutting back and forth from the times he is describing to the future in which he is living, telling several stories in parallel, commenting on everything crustily and lustily. Although he represents Lazarus Long as basically conservative, handicapped by his post-Victorian midwestern upbringing, he offers us several variations on group sex and the multimember family, which should sell books to the young crowd who have found the philosophy of "Stranger in a Strange Land" a guide to living.

Finally, the Lazarus Long of the Forty-third Century goes back to 1916, to the community where he was growing up—and falls in love with his mother. He has miscalculated a little, and finds himself trapped in the First World War, where two thousand years of military experience can't buck the System.

Heinlein's old men have practically always been his best characters, but Lazarus Long, oldest of them all, just doesn't come through as the Senior. He also seems uncomfortable in his sexual emancipation. Or maybe that's just the reaction of this non-Heinlein Individual.

After all, I'm nine months older than Lazarus Long.

THE DOOMSDAY GENE

by John Boyd • Weybright and Talley, New York • 1973 • 230 pp. • $5.95

By an odd coincidence, the theme—one of the themes—of this book is precisely the reverse of that in Robert A. Heinlein's "Time Enough for Love," which came out almost simultaneously. The purpose of the geneticists in Heinlein's Howard Families was to breed for long life and intelligence, plus other survival characteristics. The purpose of the molecular biologists in John Boyd's new book is to breed *short*-lived geniuses who will achieve one brilliant piece of scientific work, then self-destruct. Amal Eugene Severn, one of five such mayflies, is programmed to make his contribution to science four months after the book begins—then die in a cataclysm of his own making.

That is only one of the themes of the book, though. Amal is a seismologist, who has come to Cal Tech to test his technique for predicting earthquakes. But Amal lives in an overpopulated world where murder, massacre, rioting, famine, plagues, and other such population-reducing processes are encouraged. This is the basic purpose of the Thanatos Syndrome bred into Amal and his fellow ephemerals—use 'em once and throw 'em away. He warns Los Angeles of a coming major quake, but Los Angeles sees a lovely way to get rid of its excess humanity, and forbids him to make his warning public. He has to go underground—to the Cal Tech student underground—to get around

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their blocks. Some of the nicest bits of detail are how it's done.

Boyd's California of the future is charmingly like the one Ron Goulart shows us in his science-fictive pieces. Androids rented out as sexual partners. A community frozen in the 1930's. A commune of back to nature "skinheads," complete with resident hermit/yogi. A preserve where hunters—for a fee—can hunt criminals or anyone the authorities dislike.

This isn't one of John Boyd's best books, but it is better than most that come this way. There are some factual slips, though things Californians just don't know about the East, I guess. For example, the fierce Mohawks come from St. Regis, not the Canadian border—they were in Utica. Utica was Oneida territory, but they are long gone, some to Canada, some to Wisconsin. The Onondagas are just outside Syracuse, but there are no more Mohawks in the Mohawk Valley.

OCEAN ON TOP

by Hal Clement • DAW Books, New York, N.Y. • 192 pp. • 95¢

This new book by Hal Clement is a mess. He writes "quantitative" science fiction of a kind that almost no other writer now does, and this is no exception to that rule. Unfortunately, this just isn't a very good one.

The tale telegraphs the basic gimmick on which the book is built, and a good deal faster than Mr. Clement now bothers to do, so that the strange phenomena that puzzle the narrator, an investigator for the Power Board who goes down into the depths of the Pacific, disguised as a piece of wreckage, to find out why three Board agents have disappeared there. Any Analog reader should know that the community he finds at the bottom of the sea is made up of people breathing some heavier-than-water liquid which does not mix with seawater. The basic trouble is that although the phenomena of such an environment are beautifully explored, they are explained in the manner of Jules Verne rather than Hal Clement. One of the missing trio tells our narrator all about them, but he experiences very little for himself. At that, the mysterious liquid and its origin are never really explained, and the civilization at the bottom of the sea remains as obscure as Captain Nemo's origins.

Engineers will probably love the details—some of them surprising—of life at the sea bottom. This technical puzzle aside, nobody is really going to care much whether our trio of topsiders returns to the surface or not. And that is *not* par for a Hal Clement story.

THE PRITCHER MASS

by Gordon R. Dickson • Doubleday & Co., Garden City, N.Y. • 1973 • 186 pp. • $4.95

This book was an Analog serial last year, and before you read this it may very well be a Science Fiction Book Club choice or even a paperback. Any book by Gordon Dickson is bound to go the whole way. I don't think it will win him any prizes, though.

As you'll know if you read the

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story here, the Pritcher Mass is a psionic construct, built on the frontier of the Solar System by Earth's paranormals—rather, by selected paranormals from a population which radiation and chemical mutation have mutated over and over. The Chosen live sealed in cities; the Fallen are shut out in the contaminated countryside. But it is apparent that there are some who have managed to find a place in both worlds. The hero, Chaz Sant, is, of course, the superman who can tie it all together and find the way to the stars.

Gordon Dickson has been criticized by the new generation of readers for harping on outworn themes. I prefer to think that he writes exceedingly well about universal themes, that the New Wavers reject out of hand and out of ideology. In this story he has moved from the outer space that he knows so well into the "inner space" that is supposed to be the key to reality and relevance and such. Perched on the edge of the grave as I am, I don't find it relevant.

THE MULLER-FOKKER EFFECT

by John Sladek • Pocket Books, New York • No. 77622 • 214 pp. • 95¢

The hardback edition of this satire was published late in 1971 by William Morrow & Co., a publisher who doesn't have much science fiction and doesn't send it out for review. By the time I had heard about it, I couldn't get it. Happily, there is now a paperback edition which I did find.

The book is an evocation of Murphy's Law: if anything can possibly go wrong, it will. It certainly does. The nominal protagonist, or victim, or what you will, is one Bob Shairp, a technical writer, and everything happens to him. He is volunteered by his employer, National Arsenamid, as guinea pig in an Army experiment to record a human personality on a special kind of tape, the Muller-Fokker tape. Some law-and-order types break in and shoot up the place, and Shairp's body is killed. His personality, recorded on four tapes, goes on sale as Army surplus. An artist gets one of them and uses it to program his painting computer. An evangelist gets another, and programs an android that takes his place very successfully—for a while. Arsenamid gets the others back.

Meanwhile, Shairp's widow is lured into becoming a successful TV personality. His young son is buried in a military school where he is driven to the point of suicide. The evangelist, replaced by his robot double, goes out of his head and winds up as a stooge for one of the cruddiest of Indians. The artist becomes a world sensation until *his* tape goes wild. It's like Ron Goulart's farces, only with more cutting edge—let's say, Goulart programmed by a Swift tape.

Then, when the tapes are at last all gathered together, the Dirty Old Man who owns Arsenamid does the right thing and uses them to put Bob Shairp's reconstituted personality into someone else's body. Unfortunately, Murphy's Law is right in there purring like a cougar.

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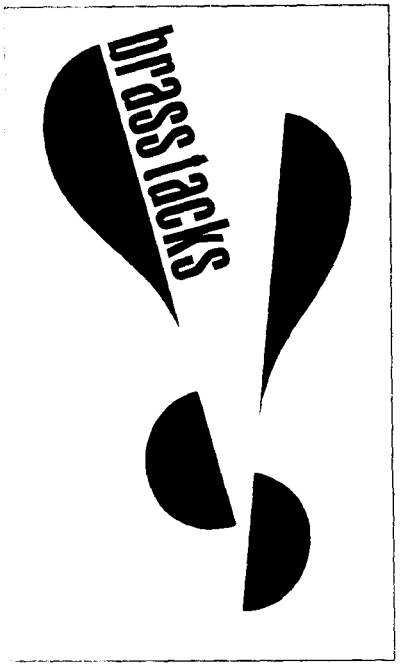

Dear Mr. Bova:

I was glad to see Spinrad's article on B. F. Skinner in the June 1973 issue, although parts were as turgid as Skinner's book. I would like to add a few points to the demolition of the Psychological Messiah.

1. Skinner ignores not only the biochemistry of the brain, but also the very structure and integration of the human nervous system. One may condition a man to think sex is bad, but he will *feel* it is good because his brain is permanently wired that way. Recent work indicates certain other actions are internally motivated, effectively free from external reinforcement. As with sex, conditioning against these actions would eventually yield a neurotic or psychotic individual.

2. Skinner ignores avoidance conditioning in which extremely harsh punishment keeps animals from completing pleasurable actions such as eating. Punishment does not efficiently imprint new behavior patterns as reward does, but punishment does inhibit old, learned patterns while reward doesn't.

3. Skinner, in advocating the "piloting" of society, misses two biologically oriented points. First, all men are not alike. There will always be individuals who won't fit into any pattern of social conditioning—extreme extroverts, for example. By definition and experiment these people are retarded in conditioning and exhibit rapid extinction of conditioned behavior patterns. Simply, social control can't work because of individual variation within a species.

No sane individual would want to be responsible for a monolithic society. In a species it is the variation within the gene pool which allows some members to survive if there is a sudden ecological reversal or change. Species without these insurance genes become extinct. Society is no different. Looking back on history, the remarkable continuity of civilization is due to such adaptability. Christianity would never have survived in early Greece. With the conditions at the beginning of the Third Century A.D., it flourished. Conditions changed so that the structure of Christianity (values, concepts, physical foundation) had immediate survival value . . .

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4. We *do not* now have the capability of Skinneristic social control. Empirically we do O.K. at times, but we are psychologically ignorant. We cannot (even in the laboratory sometimes) predict, and therefore can't control.

Finally, the complexity of the universe is such that free will does exist, subjectively if not philosophically. The arrogant simplicity of Skinner will not change it.

WILLIAM PETER MARCH
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Free will can be twisted, though, by clever manipulators—see Mark Antony's funeral speech in Shakespeare's "Julius Caesar."

Dear Mr. Bova:

Norman Spinrad's Skinner article was very good. In fact, the best anti-Skinner argument I've seen yet because it granted all the premises and arrived at a contradiction in the system.

I would like to throw out this argument for thought:

In small cultures, with a limited gene pool, you find that they are unchanged after thousands of years. By Skinner's premises, they have no reason to change—the culture meets all needs, and the biochemical factors are within a tight boundary. Outside contact is the villain in the picture.

We can presume that at some time in the past mankind lived in similar situations. Question: where did progress come from? Is the two percent "end" of a normal distribution curve able to lift its brothers out of one culture into another? In a Skinner-type model that is the only place it is able to fit in. Somebody didn't like something and changed the world, by making a wheel, fire, et cetera.

By just pure math, this two percent is the result of random factors in the gene pool. It is pretty hard to call something a scientific predictor if it can be thown off by a random chance, and it is impossible to really use it for long-term planning.

Going back a minute to the frozen cultures, I can still keep my random factor in cultures that have not changed on the grounds that the populations were so small that the absolute number of two-per-centers could be taken care of by the culture (eaten, killed, ignored, et cetera). But as the population gets larger, the two percent becomes a significant quantity, though still a small percent.

Some models in the physical sciences make this a reasonable premise. Exactly what the level of odd-balls has to be to boil a culture, is not important.

Now, in a worldwide community with a gene pool greater than man has ever had before, we can deduce that a stable culture will have to please a very, very wide range of human beings. And the Skinner-model cannot do that on a large scale. It presumes that you can predetermine what a person's chemical make-up will want (which you can, perhaps, with gene engineering someday, but not any time soon), and makes no allowance for a range of values.

And the larger the population,

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the sooner it falls apart. Or the tighter the culture. The answer would seem to lie in as loose a culture as possible, where everyone could drift into the sub-culture he is most agreeable to.

The great civilizations of man have all started in a band about the equator, within the tropics (Rome, Yellow River Valley of China, Mayans and Aztecs, Egypt). Granting other factors, this part of the Earth gets the most direct sunlight and radiation. Maybe that affects the gene pool and causes people who want to change the world.

JOE CELKO
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A worldwide Skinnerian society might include sub-cultures that are carefully tailored to satisfy the restless two percent. SF could be one.

Dear Mr. Bova,

I found several reasons in the June Analog to write. Some high spots in the issue were Bernard Deitchman's "Chester" which was excellently written, and of course Heinlein's "Notebooks of Lazarus Long" which although I don't care for the notebook format, was still enjoyable. "Time Cycle" by Saul Stalski was an interesting version of an old theme. The tone of "Into the Furniture" by Laurence Janifer was light and amusing. I didn't care for "The Wimper Effect" by J. R. Pierce because of its method of presentation, but the idea might have had some merit put more effectively. I never read Jerry Pournelle's "Sword and Scepter" yet since I've saved the first part to be read with the conclusion, but I hope to get to that soon.

Which brings me to the most important part, Norman Spinrad's article on B. F. Skinner. The article was well written, the author well versed on the subject, and I agree with much of what was said regarding Skinnerian behaviorism. But the determinism of biological organisms is not exclusively a tenet of behaviorism.

The various social and natural deterministic systems, I would agree, are surpassed when one is made aware of them, but the determinism of the electrochemical processes of the brain is the basic underlying factor of modern mind-brain identity theorists who contend that man is predetermined or predestined through his environment and his heritage by the nature of his brain. The brain is an electrochemical computer whose gross structure is the result mainly of genetic heritage, a theoretically predictable process, and whose repertoire of reactions is due to this structure and to programming by the environment. Since the environment is made up of matter and energy interacting also in a theoretically predictable manner (if we knew all the rules and all the quantities), the behavior of the brain should, on the same theoretical basis, be predictable down to the minutest detail, and thus from this the behavior of the animal who possesses the brain . . .

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When someone can program a computer to handle all the possible moves in a chess game, then we can begin to talk about determining the behavior of the human brain.

Dear Ben:

In the Buckminster Fuller profile (September 1972 issue), Spinrad interviewed Fuller and I was reading Fuller's words and Fuller's interpretations of those words. In the B. F. Skinner profile (June 1973), however, I was reading Skinner's words and *Spinrad's* interpretations of those words.

Here lies the big difference. Spinrad actually interviewed Fuller and wrote Fuller's ideas on what he said. Spinrad did not interview Skinner, and so he would quote a line or two of Skinner and then he would put down his own interpretation of what Skinner said. I would be more interested in Skinner's interpretations than in Spinrad's . . .

I would be willing to dismiss the above grievance, however, because Spinrad obviously did his homework on Skinner. After all, he can't be expected to be able to interview everybody he wants. And many of Spinrad's ideas did make sense. But this brings up another problem. Some of Spinrad's ideas did *not* read as "right" to me. As an example, let us say that a man (or any other animal) is conditioned to salivate at the sight of a blue circle, as Spinrad mentions on page 174 of the article. According to Skinner, the man is conditioned, so he has no free will, even though he may think he is salivating because he "wants to." However, according to Spinrad, a simple pair of tinted glasses will change all this, and Skinner's conclusions are invalidated. Spinrad argues that the senses are more basic determinants than culture because we receive the culture through the senses. But changing the input of culture will also change the conditioning. The culture is not dependent on the senses.

All this means is that, on one hand, Skinner is right, but on the other hand, Spinrad is right. This "circling" of opinions is the result of Spinrad making his own interpretations, not Skinner . . .

As for the July issue, I have to say that it is one of the best issues you've ever had! The stories were all very good to excellent . . . But, with every good, there is always something not quite as good. I'm talking about "Peace Probe." You're probably going to get quite a few letters about it, so I might as well join the group. Specifically, how is the author so sure that the United States will be such a perfect and noble peace-keeper? The story would have been much more realistic if the UDA was an international body. Sure, I would like to think that the United States would be as fair and faithful as it is in the story, but it just is not that realistic. It probably will not happen that way, if the situation comes up. Otherwise, the story was one of the better ones in the issue, and they were all good . . .

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Spinrad's point is that sensory inputs are as much of a determinant to behavior as cultural conditioning or more so. And Frosterman was writing a horror story: the world of the 1,000 is a dictatorship, the fact that we are the dictators notwithstanding.

Dear Mr. Bova:

In the nine years or so I've been reading Analog, this is the first time I've felt the slightest desire to write to object about something. My objection is to the item at the bottom of page 83 in Mr. Heinlein's "Notebooks of Lazarus Long": "Whenever women have insisted on absolute equality with men, they have invariably wound up with the dirty end of the stick. What they are and what they can do makes them superior to men . . ."

Mr. Heinlein is an intelligent gentle-human, and not, I am sure, a male chauvinist. But that item is just *stupid*.

First, I do not think women, previously, have demanded absolute equality. They certainly have never gotten it.

Second, I cannot see that we are superior to men. The ability to bear children, while vital to the race, is hardly more laudable or "superior" than is the male's ability to grow a beard.

The fact is, whenever women get special privileges they also have to put up with a lot of nonsense (to put it more strongly). A woman who has special privileges probably has no right to support herself, and in consequence has no independence. The only choice left open is to marry some man (who may or may not be a satisfactory companion and provider), and hope for the best.

I do see how Mr. Heinlein arrived at his theory, and in its way, it's logical—always assuming human beings are perfect and identical, and that the world is also perfect. But the world and the universe extend no special privileges to anyone; and, on the whole, those who do not expect privileges have an edge, in that their outlook is more realistic.

Last but not least, Mr. Heinlein, don't try to foist any privileges on me that I don't want—or that I do, for that matter. There is no reason any man ought to rush to open a door for me unless his arms are free and mine are full of books. If the situation is reversed, I'll do the same for him. That is common and obvious courtesy. Nor need he treat me as if I were a wilting violet: the chances are that I am as tall as he is, and probably quite as robust. I am not—most women today are not—the "little women" so beloved of Victorian fiction. All most of us ask is to be treated like fellow human beings, rather than expensive and pampered pets.

KATHLEEN BUCKLEY
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The ability to bear children has, in the past, made women more vulnerable to natural hazards than men, and consequently in need of protection at least part of the time. From this arose "male chauvinism"—which is now largely archaic and a good example of cultural lag. (But I still

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open the doors when escorting a woman!)

Dear Mr. Bova:

I was very much intrigued by your editorial in the July issue of Analog ("The R&D Budget"), and deeply concerned about what you said. I agree that the budget should be reapportioned along the lines that you suggested, supplying money and jobs relevant to both the national interest and environmental concerns, but how can the average citizen relate this to the President and Congress, who are mainly concerned with their own personal interests? Yet, when a person who is genuinely concerned about environmental policies has the power to do something about it, other people knock him down. A perfect example is the governor of Ohio, Mr. Gilligan, who decided to give a huge portion of the next year's budget to the Environmental Protection Agency, but the State Legislature cut it back. Again I ask, what can we do about it?

The stories in the July issue were all quite good. Anne McCaffrey's "A Bridle for Pegasus" was extremely interesting and I hope that she does more stories along the same lines. One can see traces of Schmitz' Telzey series, but it is finely mixed with her own original ideas . . .

Lyon's "City of Ul Chalan" was particularly interesting, for through the whole story James Hilton and "Lost Horizon" hovered in my mind, as well as Edmond Hamilton's "Valley of Creation." But Lyon, although possibly influenced by both, either, or even neither of these, wrote a good story. His characterization and description, particularly of Gertrude Eisenstein, were excellent.

"Peace Probe" was very good, even though the story line of America being the only country to survive World War Three with sufficient military strength has been used quite frequently. It did, however, provide a good backdrop for Mr. Prosterman's story.

The story by J. T. Lamberty, "Young Beaker," was also very good, but reminded me of Asimov's "A Feeling of Power."

"Godsend" by Edward Wellen used the worn plot of scientists hoaxing the world to get them to unite against a common enemy—but that's the feeling I got before reading the whole story. It is not that way at all. It seems as if Mr. Wellen took the Rocketman idea of the scientist working in a cave to produce fantastic inventions to help mankind, but gives the twist of Godsend having to do this through necessity, rather than by choice. Then out of desire to join humanity seizes his chance and hoaxes the world. A fantastic story for one so short. A. E. van Vogt couldn't have done a better job in a story as short.

GEORGE J. LASKOWSKI, JR.
1879 North Fourth Street
Columbus, Ohio 43201

Glad you liked the fiction. As for what to do about legislators who don't vote the way you want them to, the time-honored phrase is, "Throw the rascals out!" It can be

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...the worst enemy of the people ... fearlessness

Dear Mr. Bova:

Kudos to your July editorial. Much more money goes into laser-triggering of fusion weapons than into power generation: suppose a laser trigger were developed for H-bombs. Could it be declassified enough to be used in a power reactor? Or would all research be cut back to keep from spilling the beans?

I have a few bones to pick with Mr. Wellen's story, "Godsend." First of all the sequence of the story strains my credulity. I don't believe that even a supergenius could develop memory cells and computers, radio and television receivers, telescopes and microscopes, ground effect sleds, and laser beams out of rocks and ore in the jungle with no contact with the outside. The time tools, knowledge and materials for high technology are hard to find when one is farming a painfully-cleared plot of land for tubers and yams. Far more likely that Godsend would have struggled for a lifetime and died, leaving a sheaf of brilliant sketches, a hideous, tragic da Vinci.

Second, the premise of the story that a freakish supergenius can be accepted by "becoming" an extraterrestrial who just landed shows flaws on examination. Somewhere in this world of Cyclops babies and two-headed calves there are men and women with more compassion than a child chasing a butterfly. Some are surgeons; if Godsend could invent computers and perform corneal surgery with a knife blade, he could put a sack on his head and go to town looking for a surgeon, or even build his own. Maybe he didn't want to. A small child sometimes goes into the corner with his own marbles when rejected: "I don' wanna play with *you!*" Cripples, hairlips, freaks have existed for centuries; some have been bitter, and others have learned compassion and great strength from their rejection and struggle. Godsend didn't solve his problem by setting himself up as a fake spaceman, or God: the ones who would attack Godsend the freak for being ugly would still attack him, and the squeamish middle would worship him. This is acceptance, this hoax? Small and ugly men with spirits like their bodies have set themselves up as gods for eons, that's nothing new.

DAVID DAHLBACKA
610 North Lewis Avenue
Waukegan, Illinois 60085

Godsend was a mutant, mentally and physically. Why should he alter his physical appearance for the acceptance of the human race? Any more than a brilliant person should hide his or her intelligence to gain the acceptance of "peers."

Dear Mr. Bova:

Regarding "A Bridle for Pegasus": I'll be darned. "Effing" is one heck of a word. Shoot!

ROBERT LYRA
33-55 Fourteenth Street
Long Island City, New York

It's good to know that some of our readers can stand strong language, by golly!

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EDITORIAL

continued from page 10

Modern technology has produced computers, miniature communications devices, so-called truth drugs. Modern science has come up with psychological and medical knowledge that is being used in many interrogations of prisoners, all over the world, to ferret out information that old-style torture couldn't pry loose.

This is new science and rather new technology. It's expensive, and so far it's the exclusive property of the powerful people among us: governmental agencies and large industrial concerns.

In time, this technology will filter down to the level of the common man, and—just as the Minutemen became the equals of the Redcoats in firepower—the average citizen will be able to protect himself against bugging, and *very* persuasive interrogation.

Until then, we have a situation that many science-fiction writers have warned against for decades: the world of "1984" is not only possible today, it's already happening.

If our elected officials and the leaders of business and industry are not protecting the rights of the individual, then who will? *Quis custodiet ipsos custodes?* Who will watch the watchmen?

THE EDITOR

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